# Smithsonian

*May 1986*

Rhododendron fever (p. 52)
Here, a swelling bud gets
ready to burst into bloom

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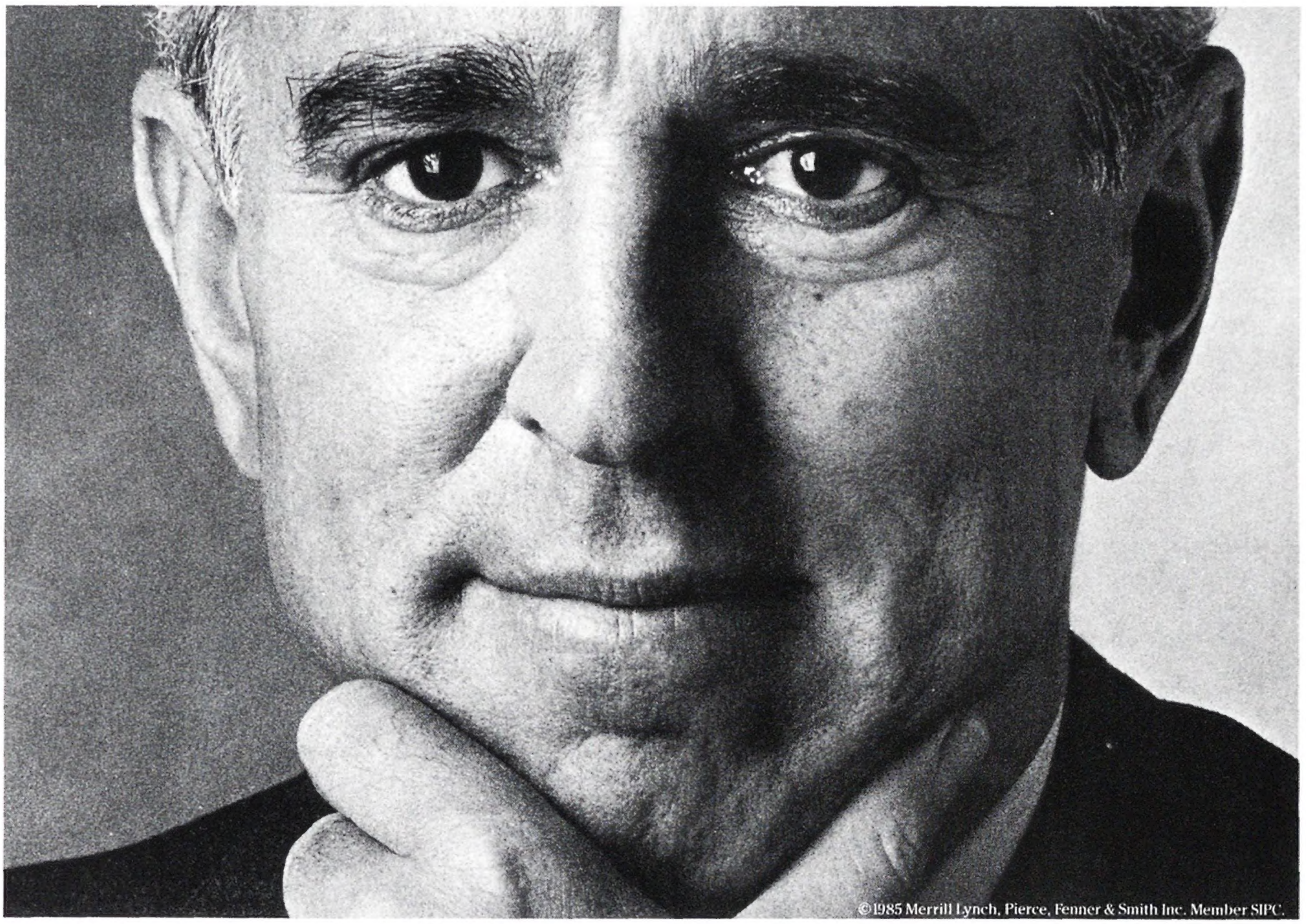

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*May 1986*

# Smithsonian

Volume 17, Number 2

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Smithsonian (ISSN 0037-7333) is published monthly
by the Smithsonian Associates, 900 Jefferson Drive, Washington, DC 20560.
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Subscription price $18 a year in U.S. possessions, $28 elsewhere. 80 percent of dues is designated for magazine subscription. Single copy price, $2.50.
Second-class postage paid at Washington, DC, and additional entry points.
Editorial offices, 900 Jefferson Drive, Washington, DC 20560.
Advertising and circulation offices at 420 Lexington Ave., New York, NY 10170.
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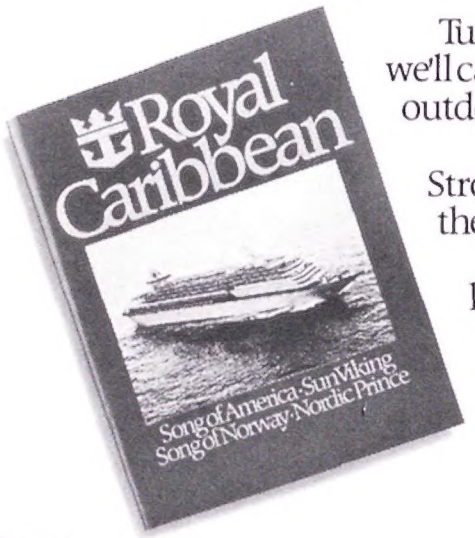


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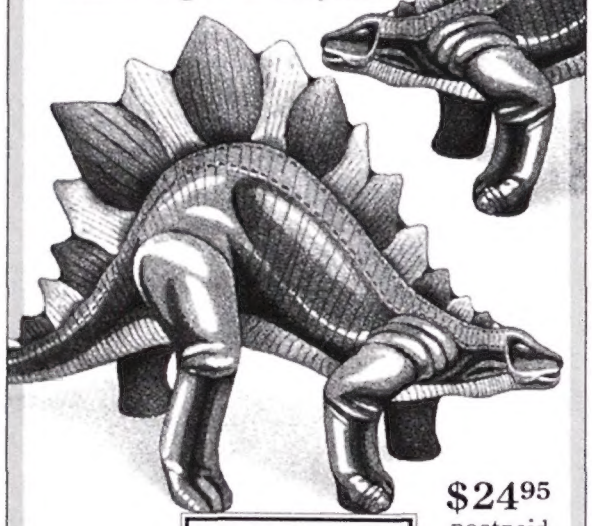

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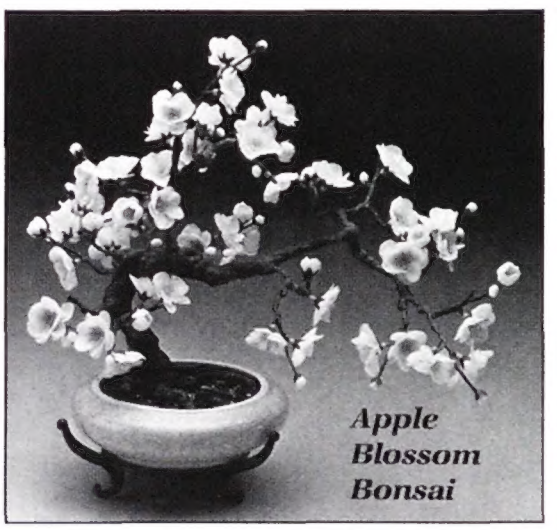


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# *Smithsonian horizons*

*New techniques for making mirrors will increase the power and availability of telescopes—and bring a flood of data*

The Multiple Mirror Telescope (MMT) is already familiar to many readers (SMITHSONIAN, May 1979). Located atop Mt. Hopkins in southern Arizona, it is jointly operated by the Smithsonian Institution and the University of Arizona. Radically new in design at the time it first went into use in 1979, it combines six lightweight reflectors whose directions are locked in under computer controls. The 1.8-meter mirrors thus become additive, providing the light-gathering power of a single reflector 4.5 meters in diameter.

We are having an extraordinary renaissance in astronomy, perhaps as exciting as any on record (*Horizons*, May 1985). Satellite viewing platforms are being combined with innovative ground-based systems designed to exploit different parts of the spectrum; as a result, new discoveries—and the theories to explain them—are tumbling after one another. A close partnership of science and technology is involved, with the line between the two virtually disappearing.

In this heady climate of change it is not surprising that the MMT is already well inside the current frontiers of planning. Its basic concept has been incorporated in designs for a projected National New Technology Telescope, and a replacement of the MMT's six mirrors by a single 6.5-meter reflector is under discussion. All of this is the result of a brilliantly imaginative series of technological advances that are coming to fruition under the stands of the football field at the University of Arizona.

While there is an operational 6-meter mirror in the Soviet Crimea, the 5-meter (200-inch) instrument on Mt. Palomar is currently the largest that is fully productive. The mere annealing of its glass blank 50 years ago took a year, and there followed years of shaping with "train carloads" of abrasives. The objective of Dr. Roger Angel and associates in Arizona is to accelerate the progress in the field by putting in place a whole chain of major innovations in mirror manufacture. He believes that 8-meter mirrors, each more than 2.5 times as powerful as that at Palomar, can be produced and annealed at the rate of one every six months or so, and finished by grinding and polishing, at a cost of $6 to $7 million. Under these conditions the demand for the new mirrors is likely to be substantial; if so, the supply of new astronomical data will become a flood.

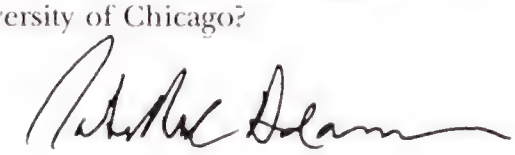
The first of Angel's innovations is a honeycomb sandwich design for the reflector blank. It greatly reduces the weight of costly glass, while retaining needed rigidity. This has the additional effect of permitting rapid adjustment of mirror temperature to that of the ambient air in the night sky, which improves image quality by reducing convection currents.

Second, he and his associates have designed a rotating oven in which to cast the new mirrors. At a carefully controlled speed the surface of the molten glass assumes the shape of a parabola, accurate to within about a millimeter of the surface that is finally desired. Finishing time, and of course cost, are thereby greatly reduced. An additional benefit is that a deep parabolic form shortens the focal length of the mirror. That permits a stubbier, less expensive telescope mounting and reduces the size and cost of the observatory housing.

Standardized 8-meter mirrors will, in short, effectively drive down costs while vastly improving performance. But will that produce a kind of lockstep conformity in the observations made with those mirrors? By no means, believes Angel. The stripped-down economy model merely provides the entry point for greatly diversified supplemental uses.

Angel and his associates have edged cautiously toward the conclusion that there is no strong reason to make single mirrors substantially larger than the present goal of 8 meters or so. Technical limits on observing conditions enter into this judgment. Unmentioned, but probably not out of mind, is the leveling off of research funds for major new facilities such as observatories. And the MMT technology permits attainment of still larger diameters through combinations of mirrors.

Interesting things happen under football stadiums. Remember Stagg Field at the University of Chicago?



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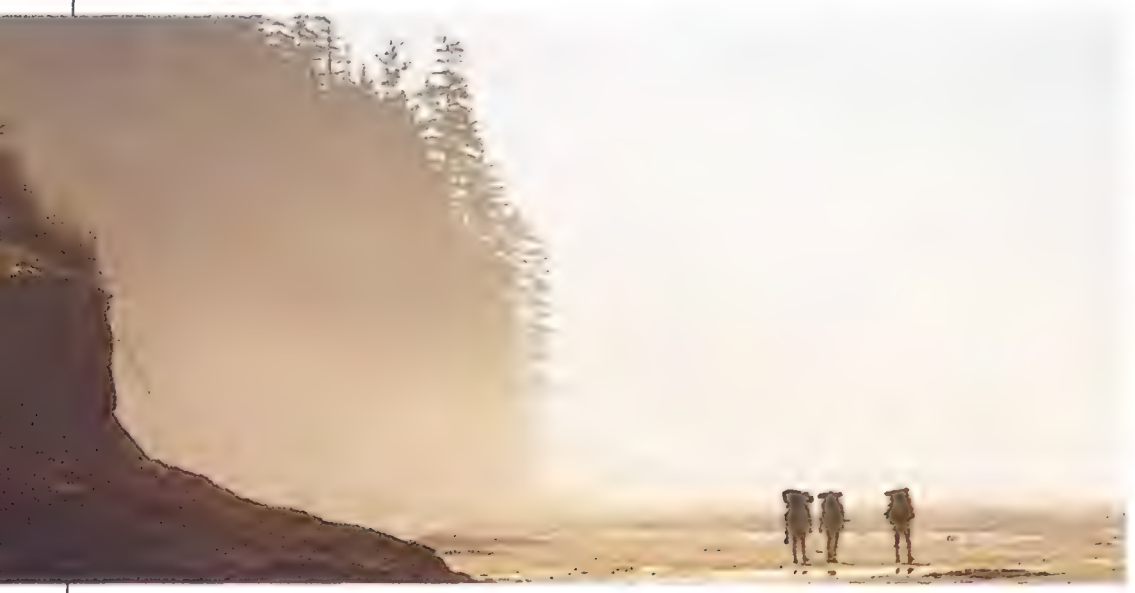

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# *Letters to the Editor*

## *Alamo*

Dear Sir: What a happy surprise to find my grandfather's painting *The Fall of the Alamo* in von Schmidt's March article. My father, Latrobe Onderdonk, a boy of 15 when it was painted, told me how Robert J. Onderdonk approached the subject.

Father's teenage friends were recruited to strike the many poses of the embattled Texans, while the family gardener and his friends and relatives were arranged on the other side. The backyard was a battleground for weeks, much to my father's joy.

That long rifle in Crockett's hands and also in the hands of the figure in the left foreground are the same. It belonged to my grandfather and after him, my father, and now hangs on my library wall.

*Dutzie Onderdonk Robbie*
Gladstone, New Jersey

Dear Sir: As a fellow historical artist, I understand Mr. von Schmidt's eagerness to correct popular misconceptions about what was worn in the Old West, but I disagree with his view that buckskin and a fur cap were not worn at the Alamo.

Crockett wrote that when he set out for Texas in November of 1835 his sole preparations were to put on a clean hunting shirt and "a new foxskin cap with the tail hanging behind," and to take up his rifle. It is unlikely that he acquired new clothing upon reaching Texas; by that time he was severely short of cash. So, at the Alamo, David Crockett was probably wearing those hunting clothes and a fur cap.

*David W. Rickman*
Westport, Connecticut

Dear Sir: Crockett had received a deep sabre wound across his forehead about two days before the final battle, and would most likely have been wearing a bandage on his head instead of a cap.

*Arnie Rein*
Lancaster, New York

Dear Sir: Properly, the Plains Rifle noted by von Schmidt was a Hawken Rifle. Jacob Hawken moved to St. Louis in 1807, and he and his brother Sam brought the Plains Rifle to the pinnacle of its glory.

Even so, its common name was the "Hawkins Rifle." All who wanted one knew what they wanted, regardless of spelling.

*Harmon L. Remmel*
Fayetteville, Arkansas

Dear Sir: Without question, the Battle of the Alamo has been romanticized and, in some cases, fictionalized. But the fact remains that the Alamo is the cradle of Texas liberty and sacred to most Texans. Men remove their hats when visiting there.

Von Schmidt's saying the Alamo was Taco-Belled is about as offensive to this Texan as it would be to say Christ fed the multitudes at Fish n' Chips.

*Isabelle R. Padgett*
Santo, Texas

Dear Sir: As finally cut and edited the story does not half do justice to the many different, misleading and outrageous accounts of Mexican and Texas casualties that Santa Anna made at various times. His estimates of Mexican dead, for instance, ranged from 70 to more than 1,000.

Your diagram is a great help in explaining the course of the battle, but some of its details perpetuate longstanding errors about the Alamo that I had hoped to correct. The south end of the long barracks had three, not two, windows. The opening of the low wall was near its north end, not in the middle and, at its south end, this wall joined a section of the low barracks that faced west onto the plaza. Most of the buildings along the wall by the pecan tree were in partial or total ruin. Except for the corner positions, the cannon on this wall were fired through windows or gunports. That at Crockett's position was fired through a notch in the palisade, not over it.

*Eric von Schmidt*
San Antonio

## *OEOB*

Dear Sir: In the late 1940s I worked at the State Department, in the Old Executive Office Building. Harry Truman was President. One day, walking outside the building during the lunch break, I passed an elderly tourist couple gazing at the monumental

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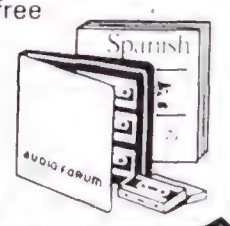


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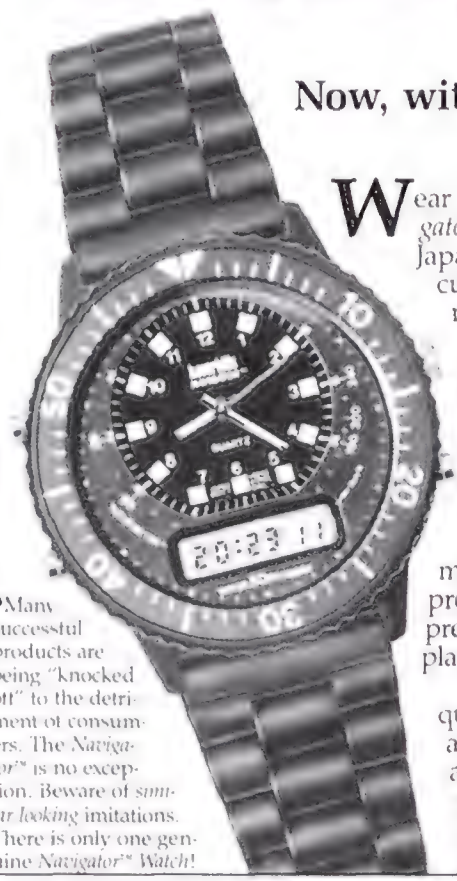

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building. One of them said, in the tone of a disgruntled taxpayer, "That's an awfully big building for a man, his wife and daughter to live in."

The OEOB has had many incarnations, but that must be the only time it was thought to be the White House.

*Russell Fessenden*
Ashfield, Massachusetts

Dear Sir: Many of OEOB's awnings were there into the 1940s, suffering from benign neglect as our wartime attention focused on higher priorities. Some along 17th Street were particularly threadbare and unsightly.

One day a brash young man reached the end of his patience, climbed onto the window sill and, outside, ripped from its frame the shredded remains of an awning. This fellow still decorates the Washington scene, but today, as Senator Claiborne Pell of Rhode Island, he tries to shed more light on matters of much greater importance.

*Fredric C. Hamburg*
Bethesda, Maryland

## *Faces*

Dear Sir: I found the composite "ideal" faces fascinating. That of the woman of 1950s is strong, mature and serene; the face of the woman of the '80s is vapid, even infantile and similar to the androgynous face on page 120.

Yet our social belief is that the woman of the '50s was submissive and male-dominated, whereas the 1980s woman is independent and strong. How strange that this shift in women's attributes is not reflected in these composite faces.

*Janice S. Aishew*
South Rovalton, Vermont

Dear Sir: Jeanne McDermott failed to give sufficient credit to the pioneer role of Silvan Tomkins in the study of faces. Both Ekman and Izard not only read Tomkins, but spent many years working with and learning from him. The photographs used in their "universals expedition" were compiled and validated on an American population by Tomkins, who made them available to Ekman and Izard for cross-cultural validation.

Darwin's ideas were ignored for nearly a century until Tomkins developed them into a comprehensive theory, highlighting the role of the face in the experience and communication of emotion, providing a rationale and the beginnings of a methodology for studying the face systematically.

*E. Virginia Demos*, EdD
Cambridge, Massachusetts

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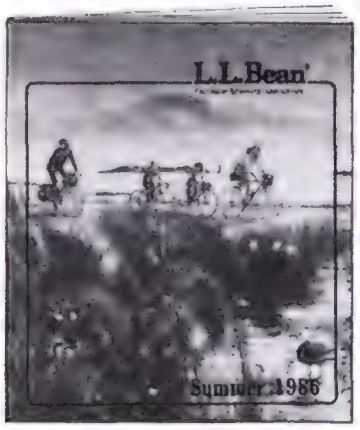


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Dear Sir: It may be true that the computer has replaced some jobs, but as a caricaturist I feel safe after looking at Susan Brennan's computer-created caricatures. Nixon's hair, Kennedy's jaw/jowls are inaccurate exaggerations. A computer cannot do eye highlights or shading or line-width differential. I suggest your readers look at Leonardo's *Five Grotesque Heads*, or Carracci and Cruikshank or Daumier for verification. When a computer can sketch faces in the dark of the theater like Al Hirschfeld . . . then I'll begin to worry.
*Jack Drummey* ("Drum")
Medford, Massachusetts

## *Motels*

Dear Sir: There was a "No-tel Motel" on U.S. 30 somewhere between Wooster and Canton, Ohio, when I was in school. It was a real thrill for some of the seniors to drive out and take one another's pictures underneath the sign.
*Linda J. Moser-DuCote*
Overland Park, Kansas

Dear Sir: My heart did a turnover and my eyes a quick double take when I turned to page 126 of your March issue and saw the Blue Swallow Motel photograph. My father, J.H. Stiles, designed the neon bird which marked the entrance and lighted each unit's doorway.
*E. Jacquelyn Stiles Kirkis*
Seal Beach, California

## *Mall*

Dear Sir: I feel obliged to point out that Gene Kelly frequently got the girl: for example, *The Pirate, Brigadoon, An American in Paris, Singin' in the Rain, On the Town, It's Always Fair Weather, For Me and My Gal.* Also, Mr. Park asserted that Kelly's compatibility with the Navy was due to his having appeared in *On the Town*. But the picture was filmed in 1949, *after* the war.
*Ann B. Soule*
Waltham, Massachusetts

Dear Sir: Mr. Park described Gene Kelly as "actor, singer, dancer and choreographer."

Gene is one of the best movie directors I've had the distinct pleasure of assisting—*A Guide for the Married Man, The Cheyenne Social Club* and *Hello Dolly!*, all three fine directorial achievements.

Having worked with Hawks, Wyler, Curtiz, Kramer, Delbert Mann and the like, I feel quite qualified in my opinion.
*Paul S. Helmick*
Granada Hills, California

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## *Origins*

Dear Sir: Here in the Willamette River at Portland we have Hardtack Island, originally Hardhack Island, after the woolly spireas that grew there. Because sailors had difficulty in tacking at the constriction in the river, the name evolved to Hardtack.

And in Alaska, before Nome was a town, a coast survey showed a cape nearby. The mapper did not know its name, so, after CAPE he added in light pencil "?NAME," which the map tracer misread as NOME.
*Kenneth N. Phillips*
Portland, Orgeon

Dear Sir: With regard to Los Angeles, may I note that the city's full name is *Pueblo de Nuestra Señora la Reina de los Angeles de Porciúncula.*
*Frank Carollo*
Staten Island, New York

## *Brontosaurus*

Dear Sir: *Brontosaurus* got as little trouble from *Tyrannosaurus* as he did from the IRS, all three being from different time periods. But Trefil can be forgiven in the light of his aversion to the name *Apatosaurus*. "Thunder Lizard" is certainly more evocative. Othniel Marsh had a way of screwing up things taxonomically. I can never forgive him for renaming his arch-rival Edward Drinker Cope's *Laelaps* something as trite as *Dryptosaurus*. Is not the name of the fleet hunting dog of Cephalus more eloquent than is "tearing lizard"?
*Eric Snively*
Fallbrook, California

Dear Sir: What kind of name is *Apatosaurus* anyhow? It sounds like something you'd buy in a deli. No, *Brontosaurus* has suffered enough indignity, what with the confusion of a few years ago regarding the shape of its skull and a history of the wrong head surmounting its noble neck in at least one prestigious museum.

*Brontosaurus* was my first-choice dinosaur as a child. I still have my *Giant Golden Book of Dinosaurs*, and feel the same horror and sadness I felt as a child when I see *Brontosaurus*, her hide scored with gashes, the jaws and cruel claws of *Allosaurus* in her neck. She is, however, not just *Allosaurus* food on the hoof: "His jaws close upon her neck. *Brontosaurus* cannot save herself now. But as she sinks, she throws her great weight upon the killer. . . . Thirty tons pin him, helpless, in the sand."

Unreal Lizard indeed!
*Christina Meyer*
Hoboken, New Jersey

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# *Around the Mall and beyond*

Three years ago I drove an out-of-town visitor down to the Mall for a day of sightseeing. As we passed the Smithsonian Castle on Independence Avenue, he looked over toward it appreciatively, as he always did when he came to Washington.

But it wasn't the old structure that demanded his attention. I doubt if he even noticed that sprawling, romantic facade, glowing warmly in the afternoon sun. He's a flower nut and what he cared about was the great old Victorian Garden spreading before it. And this time he sat up with a jolt and a cry of outrage: "What are you people *doing*? What's all this muddy mess?"

The mess, I explained, was construction. Work was just starting on the great project of putting two museums, multiple offices and an education center underground in the South Quadrangle. The garden, I admitted, was giving way to a vast hole in the ground, but I reassured my friend that it would be fully restored and then some. Nevertheless, he growled all the rest of the day, using words like "ruination" and "wanton" and "desecration."

Last winter he visited again. And again I drove him along Independence Avenue. And he was even more outraged than before. "You people haven't accomplished a single thing in three whole years," he blazed. "Look at that garden! Still just a heap of mud. That's Washington for you!"

I was finally able to interrupt him long enough to explain that what we'd accomplished was to excavate nearly four acres 60 feet deep, wall it, floor it, put in three full stories of structure in which would reside the world's newest wonder—a vast underground museum complex and international center. I was even able to make him notice, at last, the two almost completed, aboveground museum pavilions that will provide elegant public access to the treasures below, and the Kiosk, which will lead staff and Associates to new offices and classrooms for courses.

My friend was still dubious. My story of the work progressing downward and then coming back up again to ground level and above sounded altogether too pat. He knew Washington gobbledygook when he heard it. The mud was the same.

I'm trying to get him back again this spring to reassure him and reestablish my credibility. For as you read this, progress on the Quad project—that is, the underground structure and the two museum pavilions, entry Kiosk and the Enid A. Haupt Garden on top of it—is now startling. The schedule calls for most of the planting in the Haupt Garden—considerably larger than the old Victorian Garden—to be completed by the end of this month. Of course there's many a slip . . . but Smithsonian's director of horticulture, Jim Buckler, assures me that the majority of the new and exotic trees and shrubs should be in place very soon (many are already in), although the garden will not be open until fall.

The new garden will have small, grassy hills (berms) and dales, thickly planted sections and open glades, a broad decorative parterre (reminiscent of my friend's beloved Victorian Garden) and two courts where people can sit and contemplate. One will be beside a small waterfall, and part cut right into the stone benches, just behind where you'll sit. If you should happen to rest there on a particularly hot day, all you'll have to do is inch backward a bit on your bench and you'll cool off nicely, if somewhat damply.

The huge museum complex and study center that fills the four-acre hole below the garden has now reached that frustrating stage when we casual rubbernecks can't see much of anything happening. The action is almost all down inside. We are assured, however, that very soon now—in early June, it seems—the first of those Smithsonian staff members who have been assigned offices in the Quad will start moving in. And before we know it, Resident Associate programs will begin using the new classrooms and lecture hall which they have needed for many years.

What will it be like for us to work 60 feet down? One of the most daunting challenges facing Jean Paul Carlhian, architect in charge of the Quad project, was the psychological stigma of working underground. "People think of it as being sent to the salt mines," he says.

Carlhian's answer to the problem was to

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provide open spaces: a great, two-story, 10,000-square-foot exhibition hall, a skylit concourse three stories high. In such places human beings can stand tall and breathe deeply and feel that they are not a large subspecies of gopher.

Those who soon will move into the lowest (third) level of the Quad will usually enter through the Kiosk at the northwestern corner of the Haupt Garden. The Kiosk is limestone, smallish and round, with a dome covered in copper, and it fits into the gap between the Castle and the Freer. Light pours into its windows and filters down below. A staircase winds down just inside its perimeter to the first level, a distance of about 25 feet.

Here a 50-foot-long escalator meets the stairs and takes you right past the second level, all the way down to the third. The escalator enters this floor at an angle, and you step off it into a dark rotunda—green columns against illuminated brown walls. The darkness is deliberate, for as you pass through, two things happen to you. Your direction is subtly changed so that you align yourself with the rectangular plan of the Quad; second, you become attuned to the almost oppressive somberness of the rotunda.

And then you leave it quickly and you are in a bright, airy, attractive street. This is the concourse, some 280 feet long, about 30 feet wide, three stories high, with four large skylights, hidden by the garden's shrubs, bringing in light. You walk on brown quarry tiles, and on either side of you are doorways and windows, painted like those of an elegant urban mews.

The National and Resident Associate offices are to your right, with large double doors leading into the reception areas. Two long corridors entering the concourse farther along on your right lead past offices and lecture rooms to the International Center gallery. On your left, out on the concourse, a lecture hall and classrooms await you—enough of them, at last, to take care of all the burgeoning Resident Associate programs. As you continue away from the escalator, you pass under two glassed-in bridges. These are actually corridors on the second and first levels, passing over your street. Along the left of the concourse, six round planters will hold seasonal displays of exotic trees and flowering plants. Exactly halfway along, you'll walk around a murmuring fountain.

Between the two bridges, on the second level, will be two greenhouselike glass-walled offices—museum directors' offices, overlooking the street, with space for secretaries and reception rooms adjoining them. Their outlook and their flower boxes, bright with blossoms, will enhance your feeling of being outdoors. Other upstairs office windows carry on this grand deception—that you are walking along a charming, traffickless street.

You stroll on, past the entrances to the offices of the International Center and SITES, to the far end, where artist Richard Haas' mural will entrap you. He has created a trompe l'oeil of ancient stone arches, one above the other, rising from your level, suggesting that if you pass beneath them you will continue along the street in sunlight. Two classical arches, aligned directly ahead of you, frame the old turrets and arches of the Arts and Industries Building (p. 26). Through the upper arch, to the left, the familiar sandstone walls of the Castle soar above you against the sky. Both buildings appear almost where they really are. The sight of them orients you and also makes you realize just how far below ground you really are.

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ties that you Associates will soon start to use may seem strange at first, but not for long. You will become accustomed to the lack of weather. Your picturesque street is never drenched, frozen, broiled or whipped by wind. Yet, thanks to eye-boggling facilities at the south end of the structure, the air is always fresh, the temperature comfortable, the humidity controlled.

I recently returned from a winter trip to Quebec and was struck—as always—by the way many urban Canadians seem to hibernate, like their bears, vanishing underground in cold weather. Huge shopping malls and plazas extend far down, offering hundreds of shops, restaurants, theaters. "You forget what month it is, sometimes," a woman told me. "And when you step outside after a whole day below, it can be quite a shock to find a fresh foot of snow."

We hope our Associates won't find *that* when they first start using the Quad, and that they will find, instead, the garden, which will gently restore them to the world above. But I think all of us will appreciate the charming concourse and (almost) hate to leave it. If that's life 60 feet underground, then I'm a natural-born gopher.
*Edwards Park*

Section of a study by architectural muralist Richard Haas for illusionistic painting for east wall of Quadrangle concourse.


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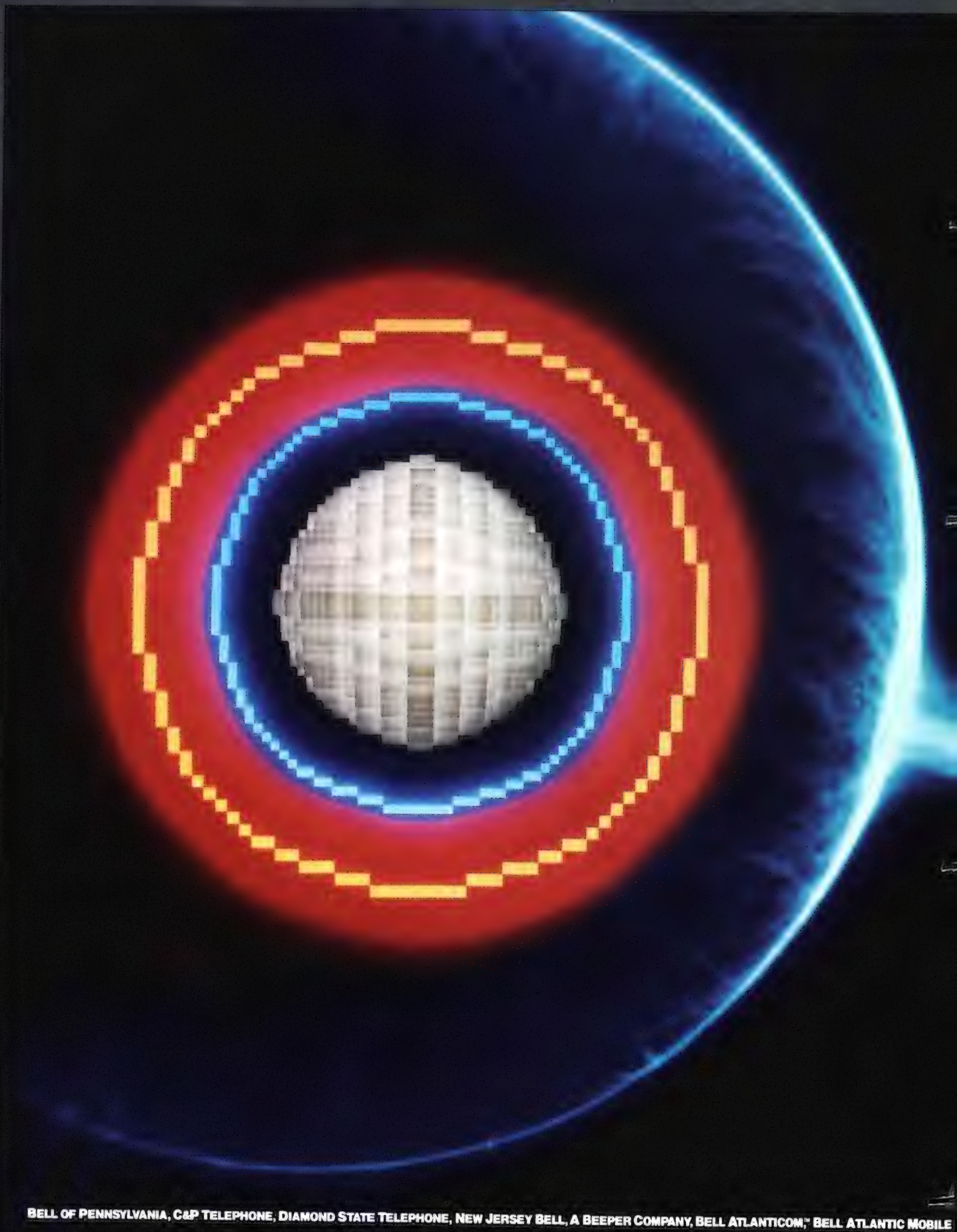

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# *Phenomena, comment and notes*

*For the amateur or professional, ornithology journals help to prove that all birds can be interesting*

One of the best things about birding, even at the lowest levels, is the sense that there are no outside limits to how far you can go. You can become as skillful an observer as you take the time and trouble to be. You can learn as much as you can soak up from an immense literature, from magazines and correspondence courses, from other birders in workshops and field trips. Winter nights can be almost as absorbing as spring mornings.

Unlike the situation in most sciences, no sharp line divides birders from ornithologists. Amateurs who do professional quality work are accepted as peers by those who make their living at it. The professional societies have a tradition of welcoming amateurs as members. Thus I, who struggle mightily to distinguish a phoebe from a pewee (don't even mention those other infamous flycatchers), happily subscribe to several professional journals.

One is the *Wilson Bulletin*, published by the Wilson Ornithological Society, a formerly Midwestern group now international in scope. The *Bulletin* offers a cross section of the field, ranging from "big-time" ornithology—parrots in the Seychelles, for example—to studies of birds I ignore, pigeons and house sparrows. I may never get to the Seychelles, but I am learning not to look down at any bird.

The March issue is a case in point. It opens with the announcement of a new species of screech owl, *Otus petersoni*, found living in the eastern Andes of northern Peru and southern Ecuador. Facing the opening page is the only color plate in the issue, a painting of the owl by the artist for

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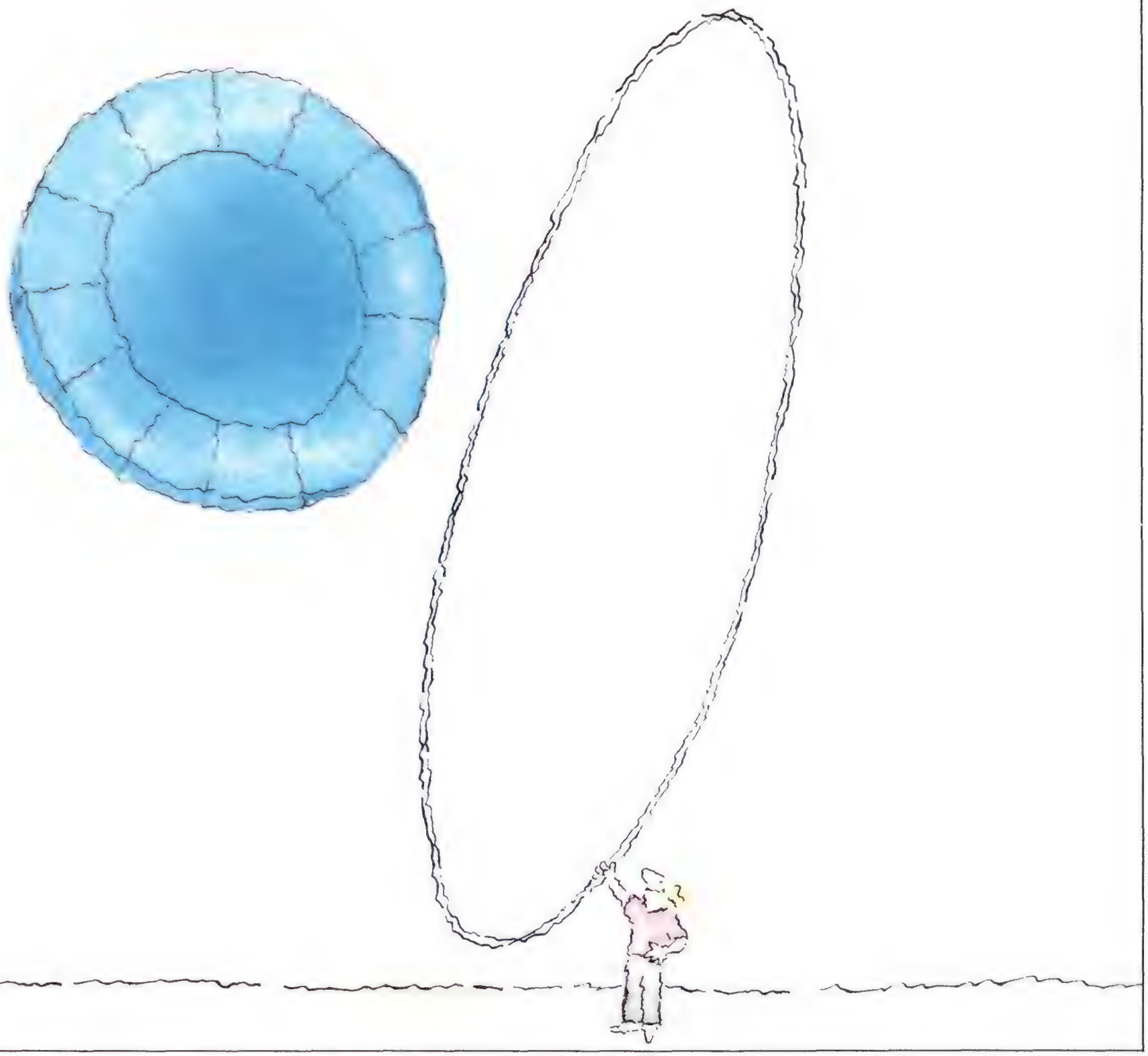

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whom it has been named, Roger Tory Peterson. The bird, to be known as the cinnamon screech owl, looks much like the rufous screech owls we see in eastern North America, ear tufts and all. It is only one of a series of new birds being found in that part of the world. In fact, this is the second new Andean screech owl to be described in five years; the cloud-forest screech owl inhabits similar terrain farther south. Authors John W. Fitzpatrick, of the Field Museum of Natural History in Chicago, and John P. O'Neill, of the Museum of Natural Science at Louisiana State University in Baton Rouge, report a second new species of bird found on the same trip, the cinnamon-breasted pygmy-tyrant. The year before, a Princeton-Louisiana State group had found two others, the bar-winged wood wren and the royal sunangel.

Further along in the issue is some new information on how much birds move around in second-growth forest in Panama. The question is not trivial: you cannot preserve a habitat, and thus a bird, unless you really know what that habitat is. Birds that are feeding in one area in January may be feeding in another in March. If you don't know the when, where and why about birds

Peregrine may have to attack five times before successfully downing quarry.

in both areas, you're likely to come up short.

Results are reported by Thomas E. Martin and James R. Karr. Martin was a graduate student under Karr at the University of Illinois at Urbana-Champaign when they did the work written up here; he is now at Arizona State University and Karr is deputy director of the Smithsonian's Tropical Research Institute on Barro Colorado Island in Panama (SMITHSONIAN, August 1975).

To find out what birds were where, they used mist nets (composed of filaments so fine as to be invisible to the birds) 13 yards long. They caught birds along lines made of at least six nets each, accumulating in two years time about 6,000 "net hours" and 1,500 birds. They ran the lines in January and again in March, looking for nonmigrant species that moved—appeared and disappeared in their records—from one period to the next. (Karr invites amateurs to join in professional work. He uses volunteers from Earthwatch to tend the nets.)

Not all the papers involve exotic birds in exotic places. One of the shorter papers analyzes the winter diet of vultures near Gettysburg, Pennsylvania. Another reports an uncommon instance of rock doves (the "pigeons" of city parks) roosting in trees in Oxford, Ohio. A short note provides what is thought to be the first record of blue grouse eating a vertebrate (namely two young northern alligator lizards).

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pressive. Over a seven-year period, Brian Toland of Columbia, Missouri, spent 3,585 hours watching 17 species of raptors hunt, measuring their success rates. He saw nearly one attempt per hour of field time and found an overall success rate of 58 percent. Toland found that peregrine falcons are successful in only about 19 percent of their attacks, the lowest success rate of any of the birds he observed. Previously published rates for peregrines vary all the way from 7.5 to 93 percent.

It all depends on what a raptor hunts and how it hunts it, apparently. Insects and other invertebrates were caught 80 percent of the time, and reptiles and amphibians almost as easily at 77 percent. Raptors succeeded 57 percent of the time when pursuing small mammals, and in 51 percent of their attempts to catch fish. Other birds were the most difficult prey, captured on only 20 percent of all attempts.

Adult bald eagles, for example, caught fish nearly half the times they tried, but birds in only two of 16 attempts. Male American kestrels caught invertebrates on 84 percent of their attempts, but birds on only 36 percent. Immature Cooper hawks went zero for ten on birds; immature northern harriers did almost as poorly—no birds in seven tries.

The how was important, too. Ospreys were most successful hunting from a hover and spent more of their hunting time doing it that way. They had 75 percent success hovering, 55 gliding and only 33 when hunting from a perch. American kestrels hunted from perches 88 percent of the time and hovered ten percent. The success rates were 76 percent from a perch and 52 for attempts made while hovering.

My favorite paper was a comparison of the diets of urban and rural house sparrows in central Pennsylvania. Some mornings last winter the black-bibbed urchins crowded the bushes around my back door, waiting for me to reload the feeders. Other birds came and went—juncos, cowbirds, the resident cardinals, even the odd Carolina wren—but the sparrows were always there, stuffing themselves and trying to drive away their peers. I figured they alone ate about $20 worth of milo seed.

In a study in the borough of State College, Pennsylvania, I discovered, half of all the house sparrows examined had been eating milo at feeders, compared to only three percent in rural areas five to ten miles outside of town. By volume, commercial birdseed was the most important part of the urban diet. More than half the urban sparrows had been eating elm seeds, and 93 percent had eaten arachnids and insects, mostly beetles. In the rural areas, 97 percent of the sparrows had been eating grain crops, mainly corn. Ninety-four percent of them also ate insects.

The researchers, Ann P. Gavett and James S. Wakeley of the School of Forest Resources at Penn State, point out that the bulk of the food eaten by house sparrows in both town and country came directly or indirectly from humans. But even for people who consider them pests, it is not obvious how to cut them off. I had hoped all winter for something as exotic as an evening grosbeak and listened sadly to telephone recordings of where they were being seen in the city. But trying to cut off the sparrows would mean I would never see a grosbeak.

This issue of the *Bulletin* goes on for 188 pages. It is information—and inspiration. I keep thinking about that 3,585 hours watching hawks, ospreys and eagles. It makes me eager to get back outside.

*John P. Wiley jr.*


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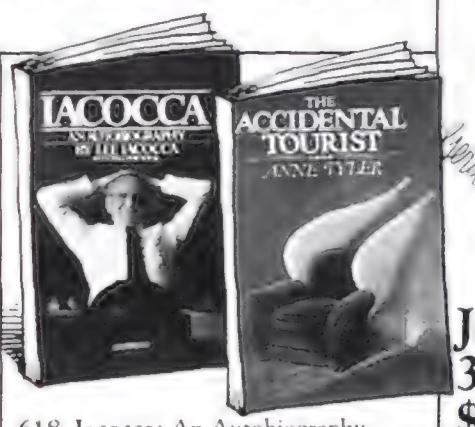


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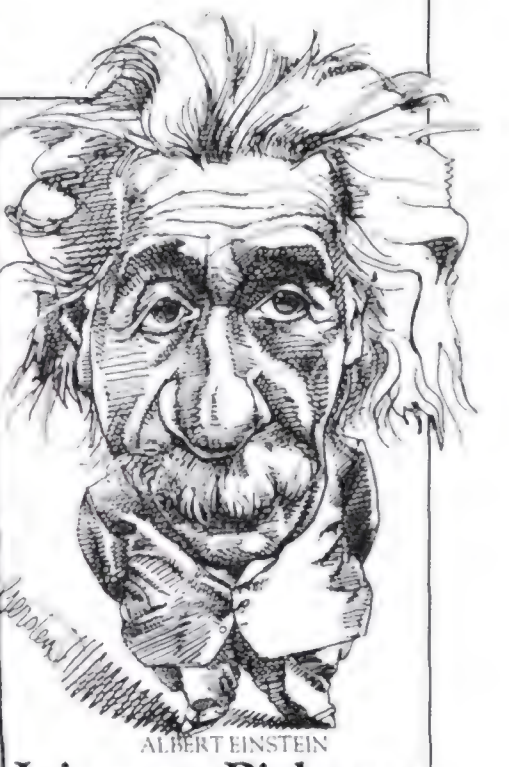

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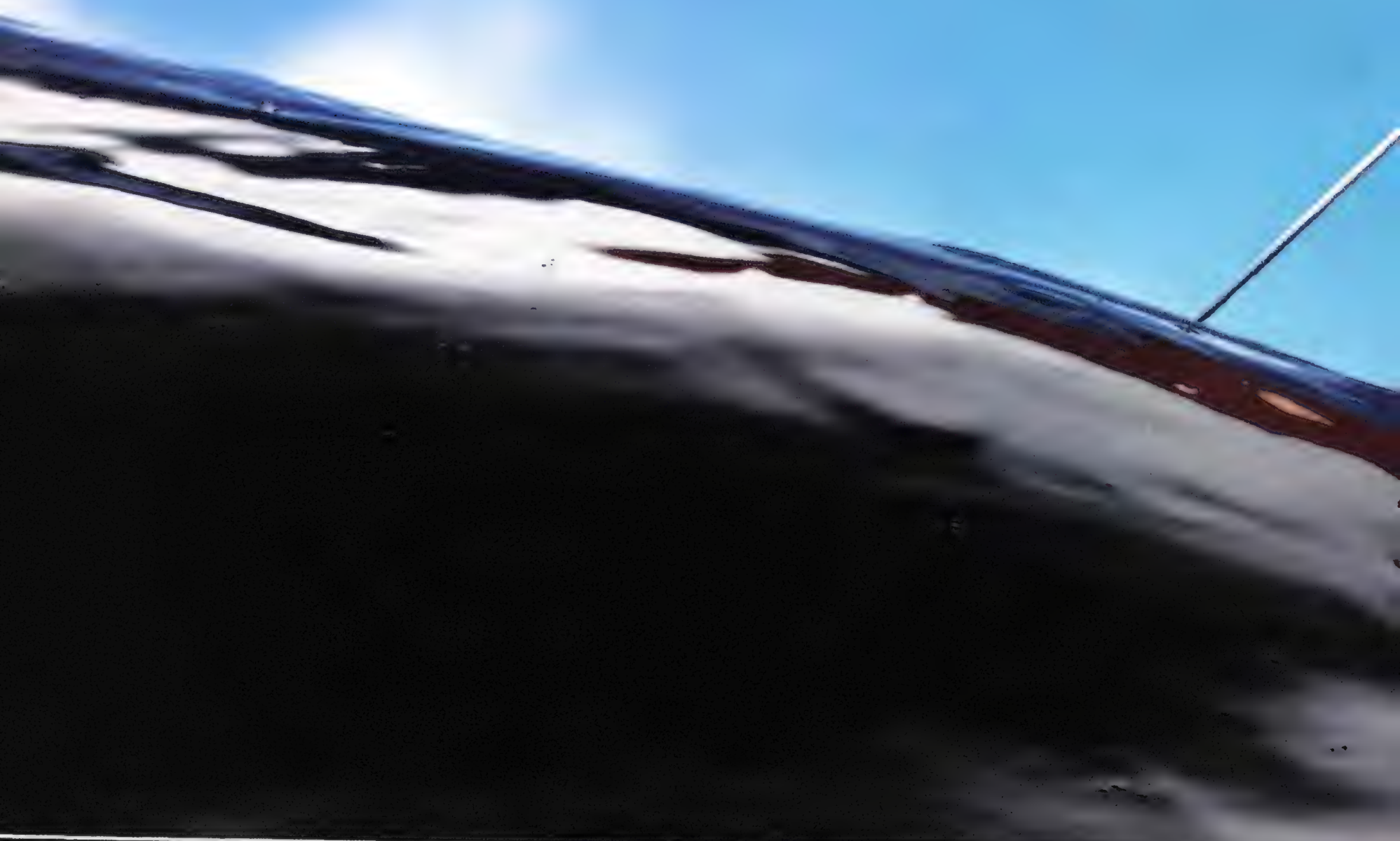

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*By William Weber Johnson*

# Two new exhibitions explore the dark mysteries of the Maya

*We once considered them peaceful stargazers, but now know that they were sanguinary and warlike—and they wanted to be remembered*

Enough is now known about the ancient Maya, those sophisticated artists and architects, astronomers and calendar keepers, to realize that much remains to be learned before all the mysteries can be unraveled. Dogged and brilliant scholars have wrestled with the problems for a century and a half. There has been a steady revision of ideas, regular expansion of the boundaries of knowledge, and there is certain to be more. The intensity of interest and breadth of work are shown by two current exhibitions of Maya art.

One, called "Maya: Treasures of an Ancient Civilization," was put together by the Albuquerque Museum and is at the Royal Ontario Museum in Toronto until June 15, after which it goes to Kansas City and Albuquerque. The other has been organized by the Kimbell Art Museum of Fort Worth and opens there on May 17, the most expensive undertaking in that museum's history. It is called "The Blood of Kings." From Fort

*Photographs by Justin Kerr*

*Shedding light on the mysterious Maya*

New Orleans Museum of Art

Terra-cotta bowl rests on four "peccary heads," which are thought to represent pillars of the world.

Worth it goes to Cleveland. Both are magnificent collections of evidence of the artistic heights reached by these early Americans. Who were they?

Scientists generally agree that their remote ancestors migrated across the frozen Bering Strait far back in prehistory. At one time there were about two million of them scattered through what is now southern Mexico, Guatemala, Belize, parts of Honduras and El Salvador. Their descendants speak more than two dozen languages or variations of the same language. By some time around 1500 B.C. they had settled in agricultural villages and had begun to build ceremonial centers. By the beginning of the Christian era these had become magnificent cities with temples, pyramids and palaces. The civilization flourished, especially in the six and a half centuries from A.D. 250 to 900 now known as the Classic period. It saw the perfection of a writing system —the only true writing system ever developed in the Americas—and some notable advances in mathematics and astronomy. These people had thought up the useful concept of zero and they had a calendar that enabled them to make fairly precise computations of planetary and celestial cycles. They could predict and record accurately eclipses of the moon and the sun, and they kept track of the paths of the planets Venus, Jupiter and Saturn.

*Hieroglyphs decorated the walls*

They had no domestic animals except for dogs, turkeys, ducks and bees, but were rich in domesticated vegetables, principally maize, beans and squash. There were no draft animals and no wheeled vehicles, but they managed to transport vast quantities of stone for their buildings. They had no metal for tools, but made do with implements of harder stone, volcanic glass, bone, wood and abrasive twine, and with these they shaped the blocks of their public structures. Big rectangular slabs of stone, called stelae, were cut, intricately carved with hieroglyphs and sculptured figures and erected in their central plazas at regular intervals. They decorated walls of buildings with more hieroglyphs and more sculpture, both in stone and stucco. The plazas in the city centers were some of the largest the world has seen—Yaxchilán's was 1,000 feet long, Copán's 780 feet.

They made paper by pounding the inner bark of the wild fig tree and coating it with lime. On this paper their scholars, scribes and artists painted elaborate records. These were people the 20th-century Mayanist Sylvanus Griswold Morley was to call "the Greeks of the New World."

But around A.D. 900 this Classic age came to an end. Artwork and building had been halted. The centers of population and ceremony were deserted, abandoned

New Orleans Museum of Art

Ceremonial offering is depicted in print taken from cylindrical vase dating from A.D. 600-800. At the right, an attendant offers tribute to a fat Cacique (chief); at the left, a woman attends another lord.

to the macaws and howler monkeys, the eroding rains and the conquering roots and creepers of the jungle.

Why? There are many possible reasons but no one that is universally accepted. Some blame warfare, although early Maya scholars tended to think of them as a peaceful people, certainly more peaceful than the belligerent Aztecs of Central Mexico. Many blame slash-and-burn agriculture, which quickly exhausts the soil and is still practiced in many parts of the Maya world today. But recent evidence has shown that some of the ancient Maya used land efficiently, employing dikes, irrigation ditches, terraces and raised fields. Some suggest epidemics. But while there was disease, the most killing diseases were introduced by the white man six centuries later. There may have been social upheaval, with peasants and workers rebelling against the despotism of kings and priests. But there is usually a residual winner in such a conflict and here there appears to have been none. Perhaps it was a combination of all these factors—or there may have been an as yet undetected natural disaster.

Whatever the reason, the Classic Maya left standing some magnificent cities: Palenque, Yaxchilán and Piedras Negras in the Usumacinta River area; Tikal and Quiriguá in Guatemala, Copán in Honduras and, the sites more familiar to tourists, Chichên Itzá and Uxmal in Yucatán.

"Mystery" or some form of it is the most frequently used word in books, articles and discussions of the Maya. The mystery has baffled the white man ever since he came to this corner of the world.

Diego de Landa, first bishop of Yucatán, in an initial burst of Catholic zeal, intensified the mystery by trying to eradicate all traces of Maya culture. He burned quantities of the codices, the native books on bark paper (only four of the Maya codices are known to survive today) that might have clarified matters and saved much later confusion. He was officially reprimanded for his excess and, becoming genuinely repentant, tried to make up for it by questioning natives about their culture, their history, their language, their writing system. His book, *Relation of the Matters of Yucatán,* is a limited document but it is better than nothing. Landa said he had been told "this land was settled by people from the East whom God had liberated by cutting 12 paths for them through the sea. . . . It must be . . . [they] are descended from the Jews."

Many other Europeans sided with Landa, finding it impossible to believe that American indigenes could develop such a high level of culture without help from the Old World. At one time or another it was argued that the Maya either were or had been guided by Assyrians, Egyptians, Phoenicians, Carthaginians, Trojans, Greeks, Etruscans, Romans, Scythians, Tartars, Chinese, Koreans, Hindus and many more. Irish Lord Kingsborough, inspired by the sight of a Mexican codex at the Bodleian Library, devoted his life to proving that the ancient Mexicans were Israelites.

The physical or intellectual pursuit of the Maya was to attract some odd characters. A Spanish artillery cap-

*Former* Time *correspondent in Mexico and Latin America, William Weber Johnson wrote on the life of Diego Rivera in the February issue of* SMITHSONIAN.

Dumbarton Oaks, Washington

Olmec quartzite pectoral dating from 1100-800 B.C. was an heirloom worn by an early Maya ruler at the time of his accession. Such pectorals were regularly used as symbols of power by the ancient Olmec kings.

Kimbell Art Museum, Fort Worth

This intricate portrait of a Maya king shows him in prescribed costume employed in bloodletting rites.

Detroit Institute of Arts

Suggestive study is probably of the moon goddess, known for her wanton behavior, and of an aging god.

tain, Antonio del Río, proudly reported in a booklet published in 1822 that in a search for treasure authorized by the Crown, he had destroyed most of the walls and windows at Palenque. The del Río report inspired "Count" Jean Frédéric Waldeck, who had served under Napoleon in Egypt, to go to Palenque and remain two years, studying and sketching the remaining sculptures and inscriptions. Many of his sketches were fanciful, showing elephants and figures in French liberty caps. Augustus Le Plongeon tried to prove that the Maya were founders of Egyptian civilization and that the Egyptians were in fact Mayas. A number of present-day science-fiction writers have even attributed the wonders of the Maya world to intervention by interplanetary visitors.

It was John Lloyd Stephens, a sensible New York lawyer turned explorer, author and amateur archaeologist, who was the first to focus careful and thoughtful attention on the Maya. With his skillful artist-companion Frederick Catherwood, he explored more than 40 Maya sites in the late 1830s and published four books that hold up very well today. Among other exploits, he bought the entire ruined city of Copán for $50.

"We are not warranted," Stephens wrote, "in going back to any ancient nation of the Old World for the builders of these cities; they are not the works of people who have passed away and whose history is lost. . . . There are strong reasons to believe them the creation of the same races who inhabited the country at the time of the Spanish Conquest, or some not very distant progenitors."

*Artful clues to the hidden past*

Aside from the ruined cities themselves with their stelae and decorated walls, the best clues to the Maya past are found in moveable art—sculpture, pottery, decorations, jewelry and detached parts of buildings such as lintels. Most of these carry hieroglyphic messages, and in the past 25 years great strides have been made in learning how to read them. It is believed that the capacity now exists to read approximately 85 percent of the known Maya hieroglyphs. It has been accomplished through the collaboration of archaeologists, epigraphers, iconographers, anthropologists, linguists, art historians and other experts as needed.

Significantly, the two co-curators of the Kimbell show are art historians, Dr. Linda Schele of the University of Texas and Dr. Mary Miller of Yale. The collection they and the Kimbell staff have assembled contains some world-famous pieces of Maya art, mostly from the Classic period. One is the Leiden plaque, a jade celt, probably originally from Tikal but found during excavation of a canal near Puerto Barrios, Guatemala, in 1864. The principal figure is an elaborately costumed lord, apparently about to accede to the throne, while a captive lord who will be sacrificed as part of the ceremony cringes at his feet. It is dated A.D. 320 and was long thought to be the oldest dated Maya antiquity. It was loaned by Rijksmuseum voor Volkenkunde of Leiden. One of the handsomest pieces in the show is the British Museum's young maize god from Copán, a bust of a young man with his hair piled up like corn silk and his arms seeming to wave in the breeze. Also from the British Museum came one of the oldest pieces in the exhibition, a large beautifully carved jade pectoral that is of almost certain Olmec origin and probably dating back to 1000-600 B.C., but on the reverse of which the Maya added some of their own hieroglyphs, probably from somewhat earlier than the Classic period. It is thought the Olmec were the cultural precursors of the Maya. The scowling portrait on the pectoral is typically Olmec. The Cleveland Museum lent a delicately carved conch shell portraying an elegant lord with a deer-head helmet at ease on a throne or bench, puffing on a long thin cigar and reaching for a serpent that is just emerging from a conch shell at his feet. The Detroit Institute of Arts contributed a pair of joined figurines from the island of Jaina. The Maya were supposed to be very circumspect about sex, but this piece suggests differently. A tall, loosely draped and clearly willing young woman is in the clutches of a lascivious old man who has one hand inside her robe while she reaches for his face.

But rather than just an assemblage of exotic and beautiful objects, the Kimbell collection is aimed at coordinating and making public recently developed knowledge about the Maya past and, in the words of

British Museum, London

Glyphs on a Yaxchilán lintel refer to a battle, the "Venus War," that took place A.D. May 9, 755.

All: British Museum, London

Jade portrait made by Olmecs shows downturned mouth like jaguar's. It later belonged to a Maya ruler.

Portrait head from about A.D. 750, part of a bride's dowry, shows features typical of the Maya elite.

Stone maize god from Copán, Honduras, is symbol of creative force. Abundant hair signifies corn silk.

the museum's director, Dr. Edmund Pillsbury, "to penetrate the world and mind of the Maya as no former exhibition of pre-Columbian art has done, demonstrating the Maya to be the first great Americans whose rulers, deeds and personalities are fully comparable to their Egyptian, Greek and Roman counterparts."

Dr. Schele, then a painter and teacher of painting, first went to Palenque in 1970. She became deeply fascinated with these most beautiful of Maya ruins and discovered that in order to understand the art and architecture of the Palencanos she was going to have to learn what she could about the hieroglyphs. She has since become a world authority in the field. "Above all else," she says, "the Maya ruler strove to be remembered—to have his name spoken by the generations of the future. I feel that I am helping to fulfill their prophecies and their hopes by saying their names and bringing them and their deeds to the attention of the 20th century."

Pacal was probably the most powerful and certainly the longest reigning (A.D. 615 to 683) of the Palenque kings Dr. Schele and her associates have identified. It was he whose remains were found in a richly adorned secret crypt at the base of the Temple of Inscriptions in 1953 (and it was a jade mosaic of Pacal found there, and pictured on page 45, that was one of the treasures stolen from the National Museum of Anthropology in Mexico City last Christmas Eve).

Reconstructing Palenque's dynastic history has been the result of the collaboration of specialists from many disciplines. Pioneer work was done by George Kubler and Heinrich Berlin. Later there were joint efforts at glyph reading by Floyd Lounsbury of Yale, Peter Mathews of the Peabody Museum at Harvard, David

Kelley of the University of Calgary, Merle Greene Robertson, a longtime resident of Palenque, and Dr. Schele herself. The result is an almost complete record of Palenque's rulers and their accomplishments from the birth of Kuk I in A.D. 397 to the accession of 6 Cimi-Pacal in A.D. 799, virtually at the end of the Classic period—a roster of 19 rulers, including two women. The lavishness of Pacal's tomb is evidence that his reign was a sort of golden age for the city state. His son Chan-Bahlum II succeeded him and his reign was almost as grand. A second son, Kan-Xul II, was next on the throne but he did not fare so well. He was captured in a war with Tonina, held captive for many years and finally sacrificed.

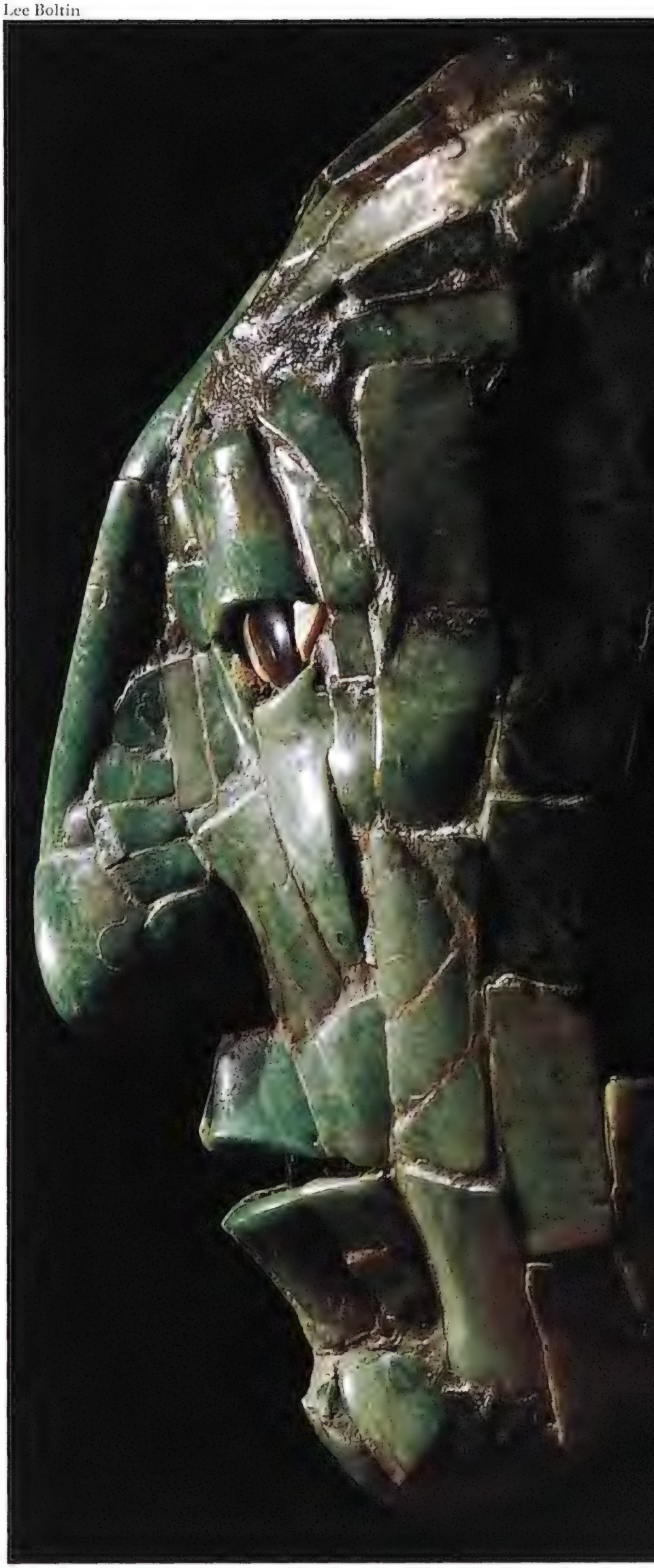
Dr. Schele concedes that the data the various rulers ordered inscribed in stone do not present a wide spectrum of Maya society at the time. "It's as if some historian of the future in studying the United States had nothing to go on but Presidential State of the Union addresses. But you can learn a lot from what the king or the President thought the people wanted and needed to hear."

For the Kimbell show the two co-curators put together a monumental catalog. They not only examined every exhibit in detail but also included eight "themes" covering what has been learned about the Maya in the past quarter century, largely through the study of Maya art and hieroglyphs.

*Calendar keepers and stargazers*

The leading Mayanists of their day, Morley and Sir Eric Thompson, are still revered as pioneers in the field, but their views are demonstrably limited in the light of today's knowledge. They described a race of calendar keepers and stargazers, totally preoccupied with time and the movement of the heavens. The inscriptions these ancients left behind were thought to pertain only to astronomical notations and calendar records. The figures in the sculptures were considered to be anonymous and impersonal priests, philosophers of time and numbers, or gods who recorded nothing about themselves. These priests lived in grand ceremonial centers. The peasantry lived around these centers, not in them, and were invited in by the priests only for special rituals and spectacles. These were not cities in the sense of live, functioning social organisms. The people were religious, modest, conservative and, above all, peace loving. There was no war. Contact between the ceremonial centers was limited to conferences on such matters as astronomy and the calendar. The Maya, it had been thought, did not become warlike until after the Classic period ended; with their agriculture impoverished, they had moved north into Yucatán where they came under the influence of the

Lee Boltin



Mosaic jade death mask is of Pacal the Great. It was stolen from Mexico City museum last Christmas Eve.

*Shedding light on the mysterious Maya*

fierce central Mexicans in the so-called New Empire. The kind and peaceful Maya then learned the bloody habits of warfare and of sacrifice, both of captives and self-induced, from the dominant Mexicans.

The discovery in 1946 of the Bonampak murals radically altered this view of the early Maya as peaceful. Here the walls of three temple ruins were covered with brilliant scenes of battle, triumph and the sacrifice of captives.

In the next decade there came important discoveries in the deciphering of glyphs. First, Heinrich Berlin described the so-called "emblem glyphs," identifying specific classic sites. And Tatiana Proskouriakoff of the Carnegie Institution "read" and analyzed the glyphs from 35 monuments at Piedras Negras, dividing them into seven groups, each representing a single reign with dates of birth, accession, marriages, military victories, captives taken and so on. These then were not gods and priests, but autocratic human rulers. They were not peaceful but warlike and, more often than not, measured their greatness in the number of their peers they had taken in battle and later killed in sacrifice. As more and more hieroglyphs were read, it became apparent that wars were frequent, particularly in the latter stages of the Classic period.

Captives were taken in hand-to-hand combat and no effort to kill was made on the battlefield. It was important that the captive be led back to the victor's city and publicly displayed there under demeaning circumstances. In some cases the captive might be made to play the traditional ball game in which the loser lost not only the game but his life. Otherwise he was subjected to a variety of bloodletting procedures such as cutting off the fingertips to produce a quantity of blood before administration of the coup de grace. His heart might be offered to the gods or his severed head might replace the hard rubber ball in the next ball game. The sacrifice of a few captives at a time was not to be compared with the Aztecs' practice of sending hundreds to the sacrificial altar in a single bloody ceremony. But, says the catalog, "in contrast the quick, deliberate heart excision practiced by the Aztecs can be regarded as a merciful act."

Autosacrifice appears to have been essential on all important occasions, but particularly so in accession ceremonies or in preparation for war. In the former, the wife of the king-designate would perforate her tongue and through it draw a rope, sometimes laced with thorns, to induce profuse bleeding. The rope would carry the streaming blood into a basket filled with strips of bark paper. When paper was saturated it would be mixed with other substances, possibly copal, rubber, sapodilla sap (the source of chicle) and set afire, producing a thick black smoke. It was an expression of piety and a call upon the gods to attend and witness the ceremony.

If a ruler was going to war both he and his wife would let blood, she in the manner described above and he by perforating his penis with a stingray spine or a lancet of flint or obsidian fashioned in the shape of a stingray spine (such a lancet became a sacred power object known as the Perforator God).

*A royal bloodletting rite*

This is all graphically illustrated in the Yaxchilán lintels, which Alfred Percival Maudslay sent back to the British Museum in 1882 and which the British Museum has loaned for the Kimbell exhibition. Lintel No. 24, dated A.D. 725, is considered one of the great masterpieces of Maya art (p. 49). It depicts a bloodletting rite that took place on October 28, 709. The ruler, Shield Jaguar, stands, torch in hand while his wife, Lady Xoc, richly dressed, kneels at his feet, pulling a thorned rope through her tongue. The next lintel in the series shows the purpose and consequences of the act. Lady Xoc stares up at an apparition of a double-headed serpent—perhaps a symbol of the royal scepter—that has arisen from a bowl at her feet. From one of the serpent's mouths emerges a figure of a warrior, believed to be associated with the Evening Star, second only to the Sun in Maya belief. The serpent's body writhes through scrolls signifying blood, indicating that the vision serpent and the vision warrior have both come from the sacrifice of blood.

In other lintels Shield Jaguar makes sacrifices of his own and Lady Xoc dresses him for war.

This all suggests hallucination. Scientists today know that the human body, in response to trauma or large-scale blood loss, can produce endorphins or enkephalins, which are chemically related to opiates and might be capable of producing hallucinogenic experi-

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*Shedding light on the mysterious Maya*

ences. Other Mexican Indians induced hallucinations with magic mushrooms from the mountains or peyote buttons from the desert. The purpose was the same: communication with gods or ancestors. The Maya are also known to have used tobacco and intoxicating enemas to produce visions.

This was not confined to the late Classic period. The Hauberg stela from the lowlands, dated A.D. 199, shows the same bloodletting-and-vision combination, in this case the vision coming to King Bac-T'ul. Sculptures and inscriptions from throughout the Classic period repeat the pattern. Bloodletting appears to have been the most important event in a king's or subject's life, an expression of piety, a communication with ancestors, a guarantee of fertility of the earth and the only way of nourishing the gods so that the Universe would continue to exist.

There are subtle differences between the two exhibitions of Maya art currently on view. The show organized by the Albuquerque Museum is larger, ranging from early pre-Classic, approximately 1000 B.C., down to the Spanish Conquest. The result is impressive but somewhat diffuse. The director, James C. Moore, said it had been decided to limit it to "the national holdings of Guatemala, Mexico and Belize, registered collections in Mexico, and pieces accessioned into American and Canadian public collections before 1970. This decision has somewhat limited the scope . . . [but] has provided a useful focus for the ideas expressed in the 1970 UNESCO convention" (a measure to curb archaeological looting). This is a stand applauded by virtually everyone except thieves and shady dealers, but it falls somewhat short of providing this beautiful but somewhat rambling show the coherence it seems to lack.

The Kimbell, on the other hand, drew its collection from a wide assortment of museums here and abroad, exercising great selectivity to make certain they illuminate recent advances in our understanding of the Maya in general and Maya art of the Classic period.

Dr. Michael D. Coe of Yale writes in a preface to the Kimbell catalog: " 'Blood was the mortar of ancient Maya life,' as the authors of this unique volume assure us. Such a statement based upon the soundest of scholarship, would have been unthinkable 25 years ago. A virtual revolution has taken place . . . in our knowledge of the New World's most advanced, sophisticated and subtle civilization, a revolution that reaches its culmination and most definitive statement in 'The Blood of Kings.' "

Baltimore Museum of Art

Figurine of a tortured captive, dated A.D. 700-900, is thought to be from the island of Jaina in Yucatán.

Lintel masterpiece shows Shield Jaguar with torch, as wife, Lady Xoc, pulls thorned rope through tongue.

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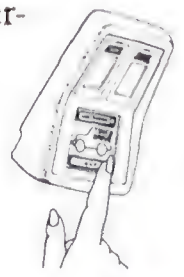

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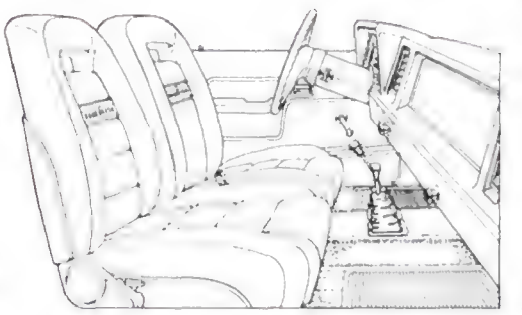

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Vireyas aren't hardy, but thrive in some temperate climates, and hybridizers are enthusiastic about them.

*By Oliver E. Allen*

# The closer you get to the 'rhodies,' the better they look

*'Rapturous,' 'Rubenesque,' 'patrician': that's what the people who love rhododendrons call these magnificent spring-blooming shrubs*

It's a good thing that Pat Halligan enjoys tinkering with rhododendrons because genetically, he says, his hybridizing project "is a long haul." A dentist who practices on Whidbey Island in Puget Sound near Seattle, Halligan has set himself the task of adapting Maddenii rhododendrons, a group of warm-region species popular in California, to a cooler environment. The Maddeniis (pronounced madden-eyes) put out showy flowers, and Halligan thinks a lot more people would grow them if he could extend their range. "I've got to find a hardy species that can cross with them," he says, "so that the progeny will be fertile. Well, there you have my project for the next couple of decades."

Halligan is one of a band of extraordinarily skillful devotees of the genus *Rhododendron* all across North America. Mostly amateurs, they are working changes on this astonishing group of spring-flowering plants, hoping to make them even more beautiful, useful and adaptable than they already are. Richard Murcott, for example, a wiry, sandy-haired supermarket-equipment supplier on Long Island, is laboring to produce a dependable scarlet red for the eastern United States. Seattle surgeon Ned Brockenbrough, a short and taciturn man, is aiming for more compact plants with stronger color. Retired 747 pilot Warren Berg of Port Ludlow, Washington, has collected rhododendrons in the Far East and interbreeds dwarf species for sale here. Meanwhile, a flamboyant former electronics executive from Vancouver, Jack Lofthouse, is bringing changes to the very shape of rhododendron flowers:

*Looking for new and better 'rhodies'*

After a hunt, Ernest Wilson and bearer exhibit results. Wilson collected plants in China during early 1900s.

some of his blooms look for all the world like orchids or lilies. "People gasp when they see them," he boasts.

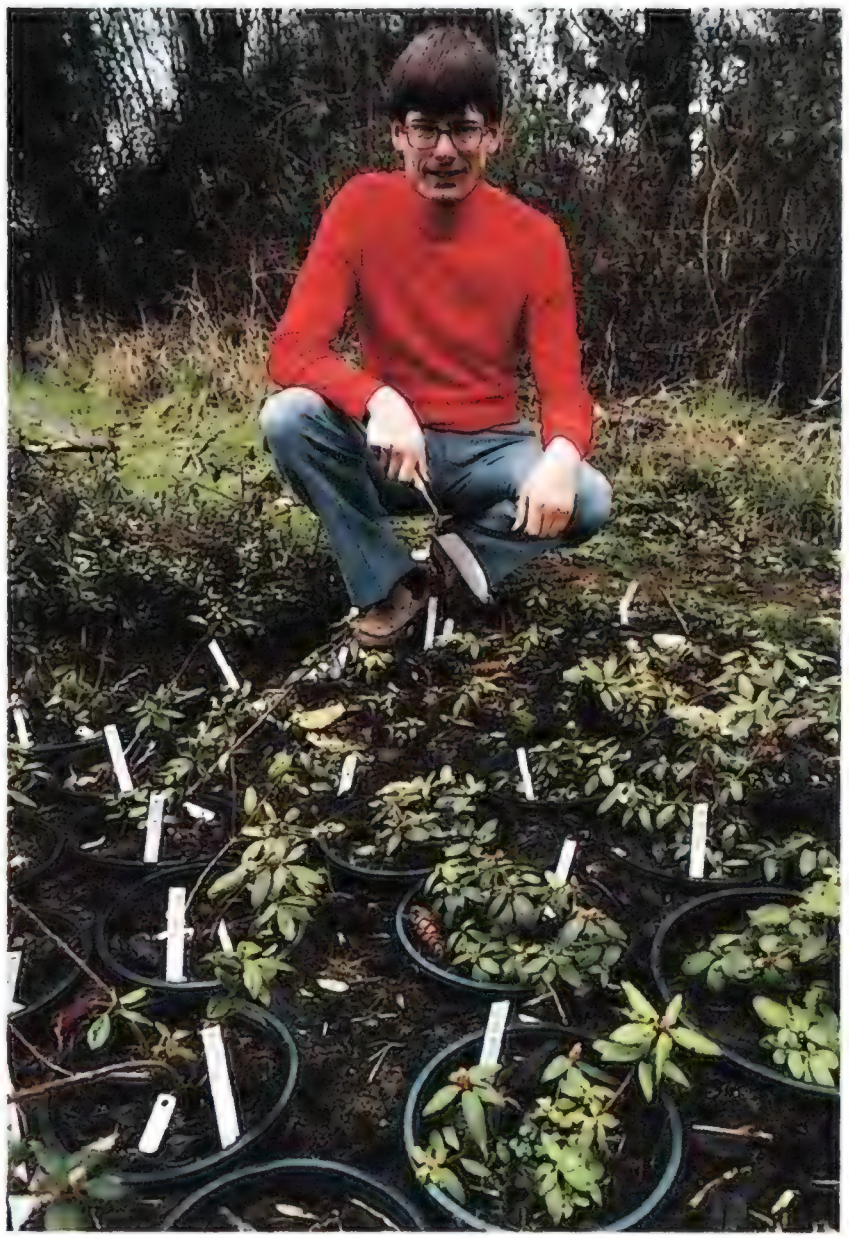
"Rhodies," as their admirers affectionately refer to these predominantly evergreen shrubs, grow wild in climates all over the world. They are found above the Arctic Circle, in the rain forests of Borneo, on the foothills and mountains of China, Nepal and Tibet, and on both coasts of the United States. They vary in size and kind from charming dwarfs barely six inches high to trees 80 feet tall, and formidable bushes billowing with brilliant clouds of fragrant flowers. Their leaves are characteristically long, narrow and dark green, often distinguished by a sheen that lends an aura of tropical exoticism even to those varieties commonly seen at alpine elevations. Their colors are at least a match for those of orchids, ranging from gorgeous whites and creamy pastels to shocking magentas, vivid blues and regal purples.

Although the cultivation of rhododendrons on a large scale is a relatively recent development, they are widely hailed today as "the crown jewels of the garden." Once confined mainly to the manicured estates of Victorian England, they have in this century become one of the most popular landscape plants in America. And no wonder. For sheer charisma, there is nothing quite like a rhody. To describe their favorites, enthusiasts resort to an extravagant language more characteristic of Elizabethan sonneteers than modern-day gardeners. "It blooms in tumbling tiers of scarlet bells, not so much in trusses as in a cascade of incandescent pendants," rhapsodizes David G. Leach, a prominent Ohio hybridizer, about a semidwarf variety known as Sumatra. (Genus and species names are italicized in scientific literature, hybrid and group names are not.) "Ruffled, rapturous, sensational!" exclaims an Oregon nurseryman over another plant with pink blossoms. Growers sometimes refer to their plants' "patrician" bearing. One fancier characterizes a particularly striking variety as "a huge, blowsy, Rubenesque sort of rhododendron with buxom trusses."

*Trying to improve upon nature*

The enormous popularity of rhododendrons is due in no small part to the hybridizing efforts of the Pat Halligans of the world. The American Rhododendron Society (ARS), to which most of these zealots belong, is far from the largest organization of plant enthusiasts in the United States, but it is disproportionately endowed with experimenters obsessed with the notion that they can improve upon nature. With less than 6,000 members, the ARS is dwarfed by the American Orchid Society, which counts more than 25,000 followers (SMITHSONIAN, November 1985). But devoted orchidists tend to be collectors rather than breeders, and

Connecticut hybridizer Gustav Mehlquist inspects hardy rhododendrons he's been working on since 1969.



Puget Sound hobbyist Pat Halligan, a dentist, checks condition of potted young hybrids in his backyard.

the same is true of another avid group, those who belong to the American Rock Garden Society.

Only the rosarians—members of the American Rose Society—approach rhododendron lovers in plant-breeding fervor. Technically, both roses and rhododendrons are shrubs. But roses (as Gertrude Stein suggested) tend to be admired as variations on a single perfect flower, while rhododendron blooms come in all sizes and shapes. "The closer you get to a rhododendron," says one aficionado, "the more architecture you see—the fluting of the blossom, the way the blossom is held."

Although a successful new rhododendron cultivar, or variety, will earn its originator a modest reward, it is the chance of making a horticultural breakthrough, rather than money, that excites the hybridizers. Not that hybridizing is in itself particularly arcane. Practitioners in effect need do only what the birds and bees do, making a "cross" by transferring pollen from one plant to another—albeit under rigidly controlled conditions—to produce seeds that in turn yield seedlings that to varying degrees will exhibit features of the two parent plants. The offspring are called hybrids. The skill lies in choosing the parents and deciding which of the hundreds (or thousands) of hybrid seedlings to keep and which to discard. "I know a guy who went through over 100,000 seedlings to get 20 or so plants that were worthy of naming," says Henry Schannen of Princeton, New Jersey.

After being selected for sale, hybrids are propagated vegetatively rather than sexually. That is, they are reproduced not via the pollen-to-seedling route, which inevitably brings variations in offspring, but by cuttings—inducing severed shoots to take root—or by grafting. The new plant is thus a clone, or exact biological copy, of the original.

Most of the gardening public does not realize how big the world of the rhododendron is. "If you go to your typical garden center to buy a rhododendron,"

*A former Time-Life Books editor, Oliver Allen now writes about horticulture. He and his wife share a New York loft with four vireyas.*

Rhododendrons, azaleas brighten up landscape at Exbury, an estate in Hampshire, England. Begun in 1920s by Lionel Nathan de Rothschild, the garden is world famous for spectacular hybrid collection.

says Richard Murcott, "you'll probably come away with a plant that was hybridized a century ago. You won't find the new stuff; the nurseryman may not know it exists. But go to a specialty nursery that sells the new varieties—and get ready to be amazed."

More than 900 rhododendron species have been identified from the wild, and hybridization brings the number of different plants you can conceivably own into the thousands. The 900-plus species are broken down into three groupings: the lepidotes, which have tiny scales on the undersides of their leaves (lepidote means scaly); the larger-leafed elepidotes, which have no scales ("e" means "without") but often have a felt-like lining called an indumentum on the undersides; and azaleas, which comprise nearly 80 species. While azaleas are included in genus *Rhododendron*, they are a separate story, and one that will not be treated here. The lepidote-elepidote division is significant. Most lepidotes are small plants that come from higher up on the mountains where rhododendrons are usually found, but because they are accustomed to being covered by a warming blanket of snow in the winter they are, paradoxically, less hardy than the elepidotes. In addition, the two groups can be interbred only rarely—Pat Halligan cannot cross Maddenii rhododendrons with an elepidote, much as he might like to.

The variety of species dazzles even the experts. In the Himalayas and western China, where many rhododendrons originate, hikers find lepidotes growing by the thousands, huge drifts of purple, pink or yellow. At lower elevations some elepidotes, like the brilliant red *R. arboreum*, may grow to 80 feet. Some species are epiphytic, clinging to trees, while others cover rocks in rushing streams. Blossoms may be trumpet-shaped, funnel-shaped or bell-like, and duplicates do not exist. "Walk through a grove of *arboreum*," says Englishman Tony Schilling, a widely traveled rhododendron buff, "and gather an armful of the blossoms. Examine them closely. You will find no two alike."

*The specialization of leaves*

Consider the leaves. They can be a quarter of an inch in diameter, or three feet long and 12 inches across. In very cold or hot weather they curl—to conserve moisture. The lepidotes' scales are infinitesimal umbrellas that protect the leaves during downpours but also trap moisture in dry spells; the elepidotes' indumentum similarly sheds excess water while allowing the leaf to breathe better, and it also deters insects. It may be fawn-colored, red, orange or dark brown. True rhododendron admirers can often be observed peering at the indumentum and gently stroking it.

Rhododendrons are perplexing, however. Many of the choicest cannot survive a winter in the colder reaches of the United States—or, if they do, they expire in a hot, dry summer. The hardiness question has been close to the core of most of the hybridizing advances of the past two centuries, as technicians have striven to cross exotic but tender species with tougher ones to provide survivability.

Until the 19th century, the only rhododendrons in the West—in Europe and Britain—were a handful of species from the Alps plus a few that had been brought back from the southeastern United States. Then came the first of what was to be a flood of lovely imports from Asia. The trouble was that the Asiatics, blooming luxuriantly in the British springtime, would be nipped by a late frost. Eventually it was found that crossing the new plants with some of the lowly American species, which were extremely tough, was the answer. There followed a succession of durable garden plants, the famed "hardy hybrids" produced most notably by the Waterer family, England's premier hybridizers.

*Risking all to acquire new plants*

The budding interest in hybridizing was fueled by the discoveries of the great British plant hunters who roamed the Himalayas in the mid-1800s. Botanist Joseph Hooker, a veteran of the scientific Ross expedition to the Antarctic and a future director of Kew Gardens, was one of them. Hooker spent three grueling years traveling in India, Nepal and Sikkim on foot, horseback, elephant and boat. He and his party contended with exhaustion, starvation, political intrigue and sabotage, leeches, insects, foul weather and illness. He sent back more than 80 "coolie loads" of geological specimens, seeds and plants, including dozens of previously unknown rhododendrons.

Hardship and privation were endemic to plant collecting. Some of the practitioners, like Hooker, were devoted scientists who also happened to be men of great courage and fortitude; others were adventurers at heart who also happened to be interested in plants. Robert Fortune, a humorless, enigmatic and sometimes disingenuous Scot, was neither a scientist nor a swashbuckler. He was a professional collector who operated in a very businesslike manner but also seemed utterly contemptuous of danger. He journeyed to China on behalf of the Royal Horticultural Society at a time of great turmoil in the Celestial Empire. He went wherever he pleased, forbidden territory or not, and usually got what he wanted. He had the good sense to contract out much of his collecting work and to procure many of his plants from nurseries. He escaped a stoning by a hostile crowd, survived a near drowning and in several encounters calmly drove off boatloads of attacking pirates with his double-barreled fowling piece. He shaved his head and masqueraded in a Chi-

*R. arboreum* is Asian precursor of many hybrids.

Tropical *R. macgregoriae* x *lochae* is vireya hybrid.

Violet *R. camptschaticum* tolerates cold, not heat.

Flowers on *R. loranthiflorum* resemble trumpets.

nese costume in order to smuggle tea out of the country. One of his most important accomplishments was the introduction to England in 1856 of a Chinese rhododendron, *R. fortunei*, that became a key hybridizing parent.

In 1876, large numbers of Waterer hybrids, dubbed "ironclads" for their resistance to punishing heat and subzero cold, were exhibited at the Philadelphia Centennial Exposition and caused a sensation. No such magnificent plants had been seen on the Eastern Seaboard—an ironic twist as they owed their existence to the infusion of American strains—and a craze for rhododendrons ensued. Many of the hybrids from that era, among them the white-flowering Boule de Neige and the lilac-rose Roseum Elegans, are still selling briskly today and can be seen blooming in untold numbers on suburban lawns throughout the Northeast.

As far as many garden-center proprietors are concerned, rhododendren hybridizing stopped right there. It did not. A flood of glorious new imports from Asia arrived after the turn of the century. One collector, the Scotsman George Forrest, devised an efficient mass-production system using native Chinese and Tibetans and, after a total of seven expeditions to the Orient, ended up introducing some 260 new species.

The intrepid Forrest's long and distinguished career as a collector was almost short-circuited early on when he and a party of 80 servants, missionaries and refugees were caught in an uprising of Tibetan lamas. Most of his companions were slaughtered or captured; one of the missionaries was tortured to death. Forrest just barely managed to escape after an agonizing, barefoot flight through the jungle and across a 17,000-foot ridge.

One of the first rhododendron hunters to collect expressly for an American institution was Ernest Henry Wilson (p. 54), who went to China in the early 1900s

Deep blue *R.* Russautinii was hybridized in England.

Pastel Hotei x Kubla Khan is a cross out of Oregon.

*R.* Spinulosum's flowers look like a pink hedgehog.

Blood-red flowers cluster like bells on *R. sanguineum.*

for Harvard University's Arnold Arboretum. An Englishman who was trained as a botanist, Wilson sent back from China so many lilies, primroses, magnolias, and roses—as well as rhododendrons—that he became known as "Chinese" Wilson. He never liked the nickname, but couldn't shake it.

On one excursion through the mountains, Wilson's train of more than 20 coolies and attendants plus pack mules was struck by a rock avalanche, which broke the explorer's leg in two places. Just as his men were constructing a splint out of camera-tripod legs, another mule train approached from the opposite direction; the only solution was to lay the patient across the narrow path so the 40-odd mules could step over him—which they did, none touching him. Each hoof, Wilson recalled later, seemed "enormous."

For all these plant hunters the masses of rhododendrons in the Himalayan uplands were stupefying. Wrote England's Frank Kingdon-Ward, an insatiable explorer who collected plants wherever he found them, "What a gorgeous sight those miles and miles of colour are! Looking across the dark ocean of moorland you see the billowy hills crested with . . . drifts of purple here, of pink there."

In the collectors' wake, the hybridizers worked furiously. One of the most notable was Lionel Nathan de Rothschild, of the famous banking family, who devoted his immense estate in southern England entirely to breeding rhododendrons and azaleas. His collection, numbering more than a million plants, still can be viewed from a 38-mile network of paths. Every Friday it was his habit to speed out from London in his Rolls-Royce and, upon arrival at Exbury, distribute cigars to his senior staff, along with detailed planting instructions for the weekend. Later on, striding about the estate, he would mark the exact spot for each new rho-

Hybrid dwarfs visitor at Seattle arboretum. Pacific Northwest has ideal climate for many rhododendrons.

dodendron by poking the ground with the tip of his cane. A man who combined tremendous energy with impeccable taste, Rothschild made more than 1,200 crosses during his lifetime and registered hundreds of hybrids that have become world renowned.

Hybridizing of rhododendrons for the eastern United States got under way in the 1920s and '30s under the leadership of three strikingly dissimilar men. The first was a New England textile manufacturer named Charles Owen Dexter, who conducted a mammoth breeding program on his Cape Cod farm while—to the annoyance of horticultural historians—keeping spotty records and indiscriminately giving away unnamed plants. On his death in 1943 his collection was dispersed. One plant of unknown stock and merely labeled "#67" was found at the New York Botanic Garden, propagated and given the name Scintillation. With its splendid pink-pastel blooms, many enthusiasts consider this rhody the finest money can buy.

The second member of the triumvirate was a soft-spoken, unassuming Pennsylvania farmer named Joseph Gable who, significantly, did much of his work with the smaller lepidote rhododendrons—presaging a recent trend in popularity toward more compact plants that are suitable for homes with reduced yard space. For much of his life Gable carried on a vigorous correspondence with the third key hybridizer, Guy Nearing of New Jersey, who also bred lepidotes and whose lilac-purple Ramapo is much admired today. A poet, chess master and inventor whose life was dotted with disasters—a flood once destroyed his nursery, another time his house burned to the ground—the ebullient Nearing could hardly have been more unlike Gable. But their letters demonstrate their bond. "Rhododendron breeding," wrote Nearing in 1942, "is a sort of religion with us. If it weren't, we would certainly not put so much time on it, for it doesn't pay."

*A stronger yellow is what they want*

Today's hybridizers, while pursuing their diverse goals, would probably agree that two concerns are uppermost in the minds of many breeders and other rhododendron fanatics. One is the continuing quest for hardier plants. The other is the search for a really strong yellow—and better yet, one that is hardy. A fully saturated yellow rhododendron flower, one with the color intensity of a buttercup or a yellow rose, has never been achieved, though Ned Brockenbrough has produced some in Seattle that are assuredly lovely.

Two men who are considered the deans of present-day hybridizers, David Leach and Gustav A. L. Mehlquist, have thought long and hard about these concerns. Leach is a donnish, pleasant-faced writer and retired geneticist, whose 29-acre farm in northeastern Ohio reflects his lifelong addiction to the genus. He was among the first U.S. hybridizers to experiment with *R. yakushimanum*, a strikingly handsome, low-growing elepidote brought in from Japan in the 1950s that is valued for its hardiness as well as its compact form and fine pink-to-white inflorescence. He has also produced many a yellow, only a few of which completely satisfied him. But his optimism, like that of all plant breeders, is unquenchable. "I'm about to introduce a hybrid that will be truly deep yellow," he said recently, "and truly hardy." His colleagues are waiting.

While Mehlquist has similarly tried to breed a good yellow, he is universally revered throughout the world of horticulture for his tough views on hardiness. If a plant cannot survive in his yard of several acres in Storrs, Connecticut, where temperatures frequently drop below zero and remain there for days on end, he deems it unacceptable, and says so. A shy, gaunt octogenarian whose austere mien hides a gentle nature,

Bill Heater
Age 30
Married, two children

Income
Single Income $35,000

Estimated Expenses

| | |
|---|---|
| Income tax | $8,500 |
| Rent | 8,500 |
| Food, Clothing Insurance | 13,000 |
| | $30,000 |

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Anthers and stamens extend beyond crimped petals of flowers on *R. spinuliferum*, which are in full bloom.

"Doc" Mehlquist has not yet introduced a hybrid to the trade but has given many a cutting to nurserymen who have named and sold the resulting plants. He too has done extensive work with *yakushimanum*.

"This plant over here," he says while guiding a visitor through his collection, "is *yakushimanum* crossed with *wardii*. Notice the buds—they were wrecked by that frost we had last week. So I'm not sure about it. But this one"—he points to another—"has great promise. It is *yakushimanum* and the hybrid Besse Howells, and I think it could be a success." Talk of this kind brings palpitations to his fellow hybridizers. "Doc Mehlquist is sitting on a lot of terrific plants up there in Storrs," says one. "Whenever he decides to release them, watch out."

Even as the work proceeds, some things have been going on that may significantly alter the hybridizing scene. One is the advent of tissue culture, a propagating technique (involving the placing of tiny plant parts in a chemical mix) that is astonishingly fast and can thus greatly shorten the time needed to perfect and produce a new plant. "You can have thousands of plants from just one in 30 months," marvels David Leach. Not only will breeding time be cut; all sorts of plants like *yakushimanum* and its hybrids, which take a long time to propagate and are thus too expensive for many garden centers to carry, may become readily available to the larger gardening public.

And the store of raw material on which hybridizers may work their wiles keeps growing. Not only do modern-day plant hunters continue to bring in forms of species hitherto unseen in the United States, but an entire subgenus of rhododendrons has recently set ARS members abuzz. The new plants are the vireyas (pronounced vie-ray-ahs), tropical rhododendrons from Indonesia, New Guinea and the Philippines that have long been known but until the past couple of decades were largely ignored. Now everyone is talking about them. Some vireyas display a bold yellow flower (pp. 52-53) but these plants will not survive temperatures lower than 28 to 30 F, and they can't be crossed with traditional landscape rhododendrons. They do flourish on a sunny windowsill, however, and what happened a generation ago, when the African violet became so popular, may happen now with the vireyas —and why not?

No story about one of the world's most beguiling plants would be complete without some reference to its lurid past. Acetylandromedol, a deadly poison, is found as a concentrate in the nectar of many rhododendrons and it has changed the course of human history more than once. In the Golden Age of Greece, the soldiers of the historian-general Xenophon were knocked out of action by honey tainted with the stuff. Nearly 400 years later the same thing happened, in the same part of Greece, to an army of Roman legionaries commanded by Pompey. The disabled Romans were slaughtered by a Pontic army, a humiliating defeat that indirectly helped set the scene for the reign of the first triumvirate: Pompey, Crassus and Julius Caesar. In the 1500s, the French queen Catherine de Médicis rid herself of troublesome courtiers by giving them pairs of luxurious gloves lined with a material that had been soaked in a lethal rhododendron extract.

Not long ago, David Leach had a different kind of encounter with poison while collecting vireyas in the wilds of New Guinea. During a violent rainstorm, he took refuge beneath a tree. In a short time, his vision began to blur, his eyes became unbearably painful and soon he was blind. He very nearly drowned in a rushing watercourse and remained sightless for several days thereafter. Leach could only deduce that he had taken "shelter" during the downpour under New Guinea's equivalent of a Caribbean "blister tree," which in a rainfall produces a caustic drip that can raise blisters on the skin. All that for the love of rhododendrons.

Growing wild in a fir forest, native species gets a little "leggy" but it's still Washington's state flower.

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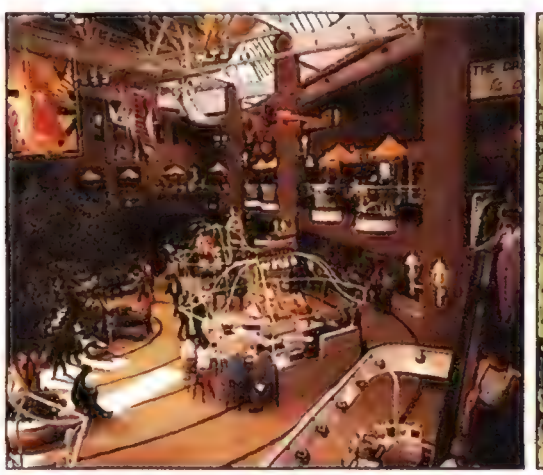

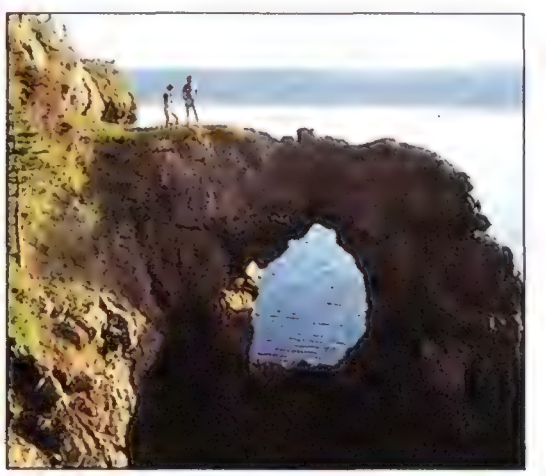

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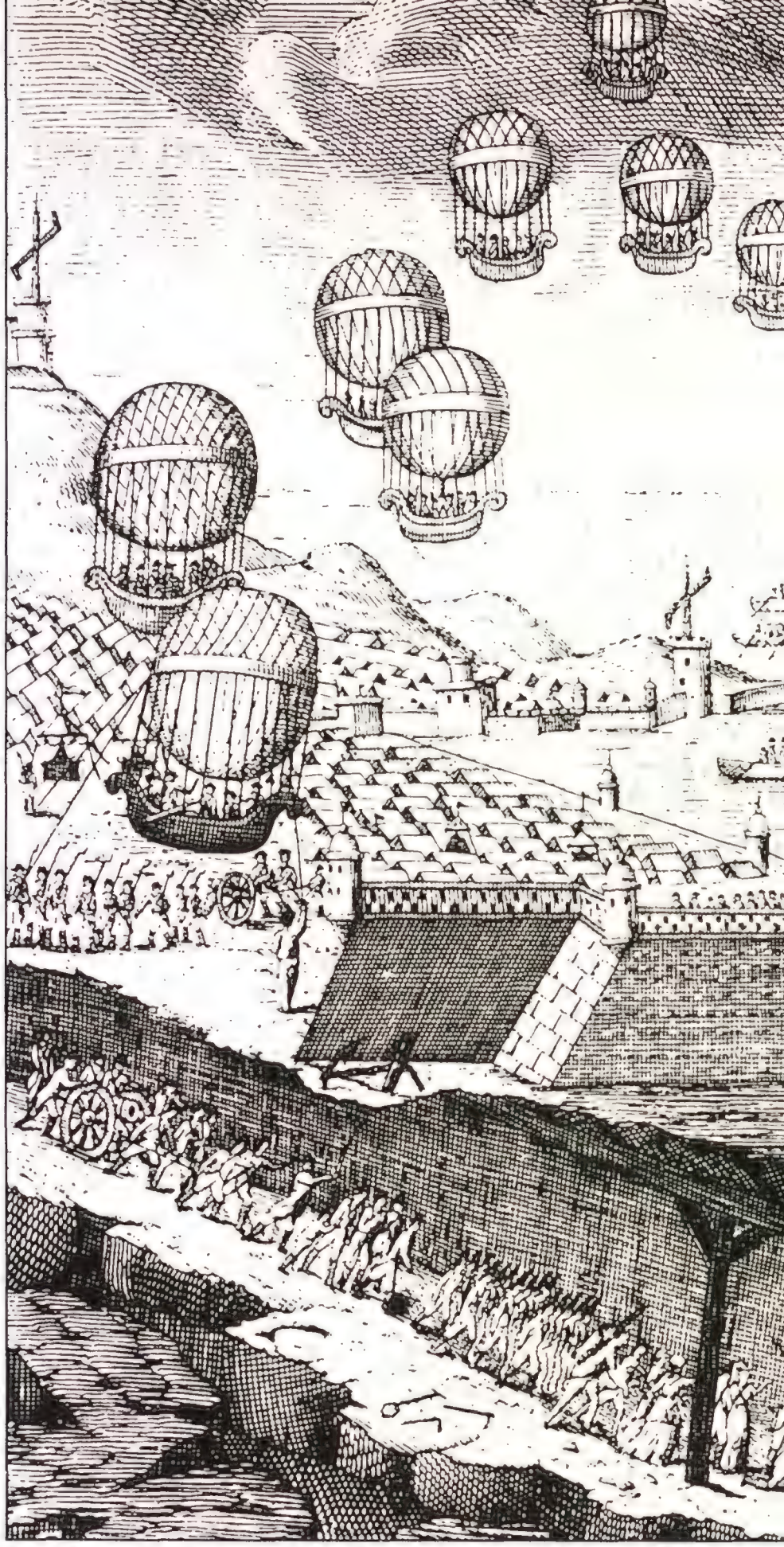
## NEW BRUNSWICK

Canada's Picture Province

*By Donald Dale Jackson*

# The ins and outs of a dangerous and boring subject

*From the first Thames River tunnel to new plans for the 'Chunnel,' underground progress has been dogged by lots of woe*



Engraving amply illustrates why England has always been wary about building a cross-Channel tunnel.

Marc Brunel could not shake the dread that tormented him awake and asleep, the sense that a catastrophe could strike at any moment. And in his business it could. Brunel was an engineer and his business in the spring of 1827 was supervising construction of one of the most daring engineering enterprises yet conceived, a 1,200-foot-long tunnel under the Thames River in London. "What anxiety, what fatigue both of mind and body," the 58-year-old Brunel wrote in his diary. "Every morning I say, 'Another day of danger over.' " But the danger was never over. "A disaster may still occur," he wrote in early May. "May it not be when the arch is full of visitors. It is too awful to think of it. I have no rest, have had none for many weeks."

The French-born Brunel was a courtly aristocrat whose reputation as an inventive genius was well established, but his fretfulness about his first subterranean foray was justified. No one had built a tunnel under a navigable waterway before. To bore through the clay and silt below the Thames he was relying on a strange-looking machine of his own devising, a 38-by-22-foot cast-iron "shield" that filled the space at the "heading" or action end of the tunnel. This protected against cave-ins, of course. But the shield also had slots through which 36 men at a time, working in separate compartments, could hack at the earth out ahead of it with picks and shovels. Every so often, when enough earth had been dislodged, the shield would be inched forward by means of screw jacks thrusting against the brickwork tunnel walls that a work crew, which was trailing behind, set in place as the shield progressed.

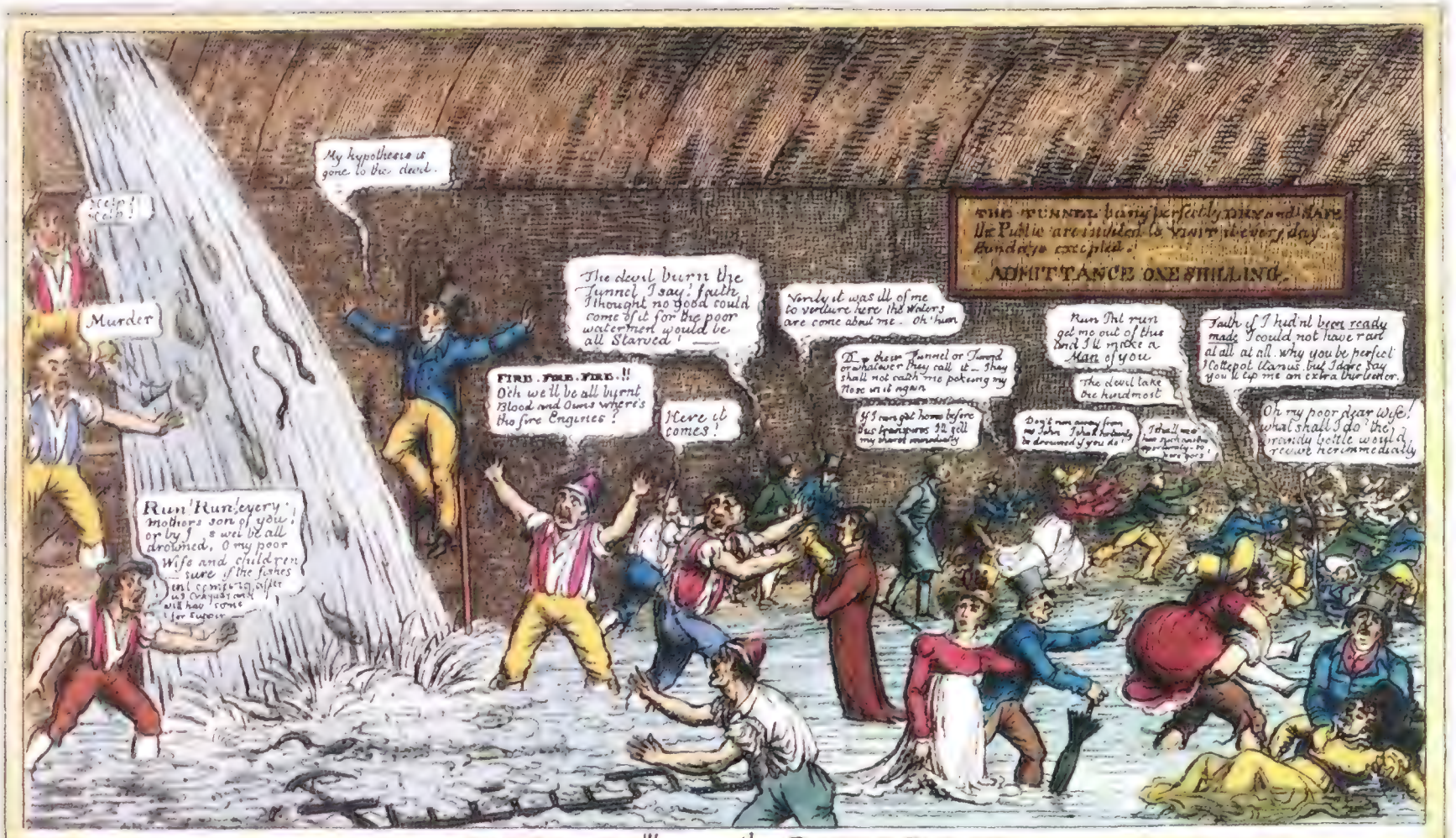
The shield ate through earth in the same way that its inspiration, a shipworm that had caught Brunel's eye on the London docks, ate through timber. But although it would ultimately become the model for the underwater tunnel-drilling machinery that followed, in 1827 the shield was still in doubt. Brunel was also jittery because his horizontal shaft was only 14 feet below the riverbed and he knew that his men could

Done in 1803, it shows a three-level attack on Britain from Napoleonic France (left). Perfidious Albion is vastly outgunned: aloft, the English have only kiteborne musketmen to fight off French balloons.

hit pockets of sand or gravel connected to the river at any time, causing a cave-in.

It happened under the Thames on the evening of May 18 (p. 68). A powerful stream of slush and water spurted out of the dirt wall in front of the shield, knocking several men to the ground. Others jumped down and ran toward the stairs with the water in pursuit. The fast-rising torrent swamped the gas lamps and snatched up timbers and casks as the men crowded the stairs five at a time in the sudden dark. Many were swimming by the time they reached the stairs. One horrified older workman found himself trapped when the bottom of the stairwell gave way, but Brunel's 21-year-old son Isambard slid down a rope and plucked him out. Astonishingly, every one of the workers and visitors who were in the tunnel managed to escape.

On the Sunday after the flooding, a minister at a nearby church declared the accident "a just judgment


My hypothesis is gone to the devil.
Help! help!
Murder
Run! Run! every mothers son of you; or by J—s we'll be all drowned. O my poor Wife and children — sure if the fishes [illegible] coming after us they shall have some for supper
The devil burn the Tunnel I say! faith I thought no good could come of it for the poor watermen would be all Starved! —
FIRE. FIRE. FIRE.!!
Oith we'll be all burnt Blood and Owns where's the fire Engines?
Here it comes!
Verily it was ill of me to venture here the Waters are come about me. Oh! hun
Do these Tunnel or Tunnel or whatever they call it — they shall not catch me poking my Nose in it again
If I can get home before the Frenchmen's 12 tell my shareholders immediately
Run Pat run get me out of this and I'll make a Man of you
The devil take the hindmost
Don't run away from me John for if I'm drowned you do!
I shall not have such a master any more
Faith if I had'nt been ready made I could not have ran at all at all. why you be perfect Collepot Manus but I dare say you'll up me an extra shilleder.
Oh my poor dear wife! what shall I do? this unlucky bottle would receive recommendation
THE TUNNEL being perfectly secured ALL the Public are invited to visit it every day Sundays excepted
ADMITTANCE ONE SHILLING.

THE TUNNEL !!! or another BUBBLE BURST !

MORAL.

British cartoon makes light of near disaster in an early tunnel being built under the Thames by Marc Isambard Brunel in 1827. Although slush and water poured in, not one man—miraculously—was injured.

upon the presumptuous aspirations of mortal men," but the mortals involved were undeterred. Isambard Brunel borrowed a diving bell and investigated the hole in the river bottom. Soon the Brunels had patched the breach by filling it with bags of clay lowered from a barge. Work resumed two months later.

Like many of the tunnel builders who came after them, the Brunels were indomitable. Adversity stirred their juices, a calamity was an affront to their skill, and in the tunnel line no one need apply who responds to misfortune otherwise. A government loan refloated the Thames Tunnel project in 1835, and, after three more major mishaps, the shaft finally reached the far shore six years later.

The tunnel was formally opened with a grandly excessive festival of patriotic self-congratulation and fancy-dress promenading in 1843. Guests flowed merrily down the long staircases to the brick-lined, double-arched tunnel, where pedestrians would henceforth pay a shilling to stroll from bank to bank. The *Illustrated London News* crowed that the completion of this subaqueous marvel, which "probably will have no parallel for many ages," had the entire civilized world agog. Queen Victoria and Prince Albert visited the bore and pronounced it good. No one could predict that eventually the tunnel would become a sordid shelter for the homeless, nicknamed the Hades Hotel.

The Thames Tunnel was in fact all but obsolete even before its splashy debut. Steam-powered locomotives had appeared while it was still building, and the ensuing century of sometimes heroic, always perilous tunnel building would mainly be devoted to the accommodation of the iron horse. Brunel's tunnel, which became part of the London subway system, was a kind of overture to the era of great tunnels, introducing themes that would recur as tunnelers tried to match their skills to their vision.

They would learn, as Brunel did, that every tunnel project was a leap into the unknown, because even the best geologic forecasts were necessarily imprecise. En-

*The author, a frequent contributor, recently has written about vanishing cabooses and the U.S. Navy's famous 1838 Charles Wilkes expedition.*

gineers would also discover that tunnels usually cost more and take longer than anyone thinks they will amid the euphoria of their beginnings. Tunnelers would find that danger and death were never far away in underground work, but that paradoxically there was never a shortage of men willing to take the risks. The work was grim and hard and dangerous, but it was precisely those aspects of it that seemed to attract the men variously known as "navvies," "sandhogs" and "tunnel stiffs." A 20th-century Italian tunneler may have come as close to explaining this phenomenon as anyone. "Sometimes a balance is struck between the rock and man," he said. "Then the miner can rely only on his personal qualities—his courage, physical endurance and spirit of sacrifice."

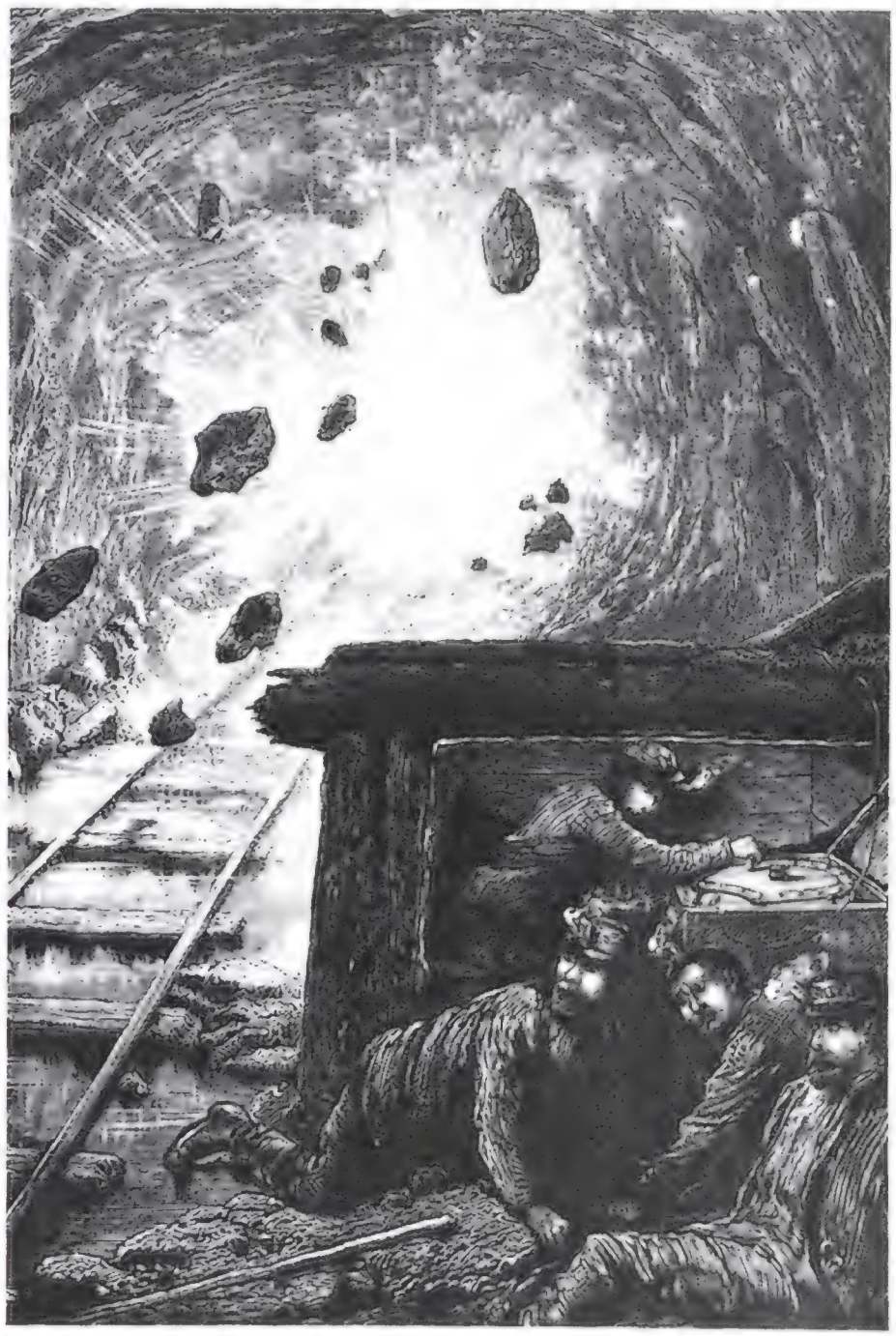
The human qualities remain important even today, when modern techniques such as gigantic boring machines and quick-setting cement are being used in the construction of the 33.5-mile-long Seikan Tunnel linking the Japanese islands of Honshu and Hokkaido. The Seikan project (p. 77) is more than twice as long as any completed railroad tunnel, and so far 34 men have died trying to build it. The project began in 1964. Work started from both ends and inched its way through volcanic rock as much as 800 feet beneath the surface of stormy Tsugaru Strait. The digging is now finished but rails must still be laid before the tunnel is opened. If all goes well, as it hardly ever does in tunneling, that should be in 1988.

Two key technical advances that changed tunnel building after Brunel's pioneering coup under the Thames were compressed-air rock drills and high explosives. By the mid-19th century these tools made practical the piercing of hard-rock mountains. Gunpowder had been used in building a canal tunnel in France in the late 17th century, but the labor of drilling holes for the charges with a hand drill was slow and exhausting. Two ambitious tunnel jobs launched in the 1850s, one in the New World and one in the Old, showed that grit and technology together could ultimately defeat the most obstinate rock.

*Cheerfully derided as "the great bore"*

The 4.75-mile-long shaft through Hoosac Mountain near North Adams, Massachusetts, took so long in the building that it became a kind of metaphor for futility, cheerfully derided as "the great bore." A huge, steam-powered "boring machine" used at the outset broke down after an advance of only ten feet. One contractor after another bailed out, and the Commonwealth finally took over the job. The Civil War intervened. By 1868 the tunnelers had been at it off and on for 17 years and had holed about a third of the distance. "When the first locomotive wheels roll through the

In St. Gotthard Tunnel in 1880, workers drill holes to insert a splendid new tunneling tool—dynamite.



In 4.75-mile-long Hoosac Tunnel near North Adams, boulders fly after explosion triggered by electricity.

Trial tunnel near Dover actually penetrated a mile under the Channel before being abandoned in 1890.

Hoosac Tunnel bore," the poet Oliver Wendell Holmes wrote, "then order your ascension robes."

Frequent accidents also stalled the work. A fire at the top of a 583-foot-deep working shaft at the projected midpoint of the tunnel trapped and killed 13 men. A 1902 magazine article noted accounts "of heads and arms blown off, of tools and trucks and men hurled through the narrow darkness, of falling boulders and sudden destruction from all the variety of causes that beset miners' lives." Estimates of the number of Hoosac deaths range from 136 to 195.

But progress could not be stymied indefinitely. A drill operated by compressed air, similar to a mechanism developed in Europe and adopted by the tunnelers then working at Fréjus in the French Alps, was introduced in 1866. In the same year the Hoosac crews began using the newfangled nitroglycerine, which broke up rock on a much larger scale than gunpowder, increasing the rate of advance to 126 feet per month. On Thanksgiving Day 1873, drillers and blasters thrusting toward each other from east and west finally "holed through," and the first train chugged through the great bore in February 1875.

When the eight-mile Fréjus railroad tunnel through Mont Cenis on the border between France and Italy was proposed, an unenlightened journalist huffed that "crossing a mountain that way is beneath the dignity of humanity. If we must visit our neighbors let us do so openly, not crawl in among them like a burglar from a cellar grating." Despite this crabby invocation, hand drilling commenced at both ends of this first major Alpine tunnel in 1857. It proceeded at the glacial pace of nine inches a day until compressed-air drilling machines designed by chief engineer Germain Sommeiller were installed in 1861. These machines used waterpower to drive the air compressors. The drills also ventilated the work face with their exhaust, a vital consideration since the headings would be almost a mile underground at their greatest depth.

*At work in a gaslit catacomb*

Sommeiller, a man both compassionate and gifted, pioneered the building of workers' villages at construction sites. The colonies he erected housed 2,000 people each and included schools, baths, a clubhouse and a hospital.

At work in their gaslit catacomb the laborers split into the specialty groups that would become standard in tunnel driving: drillers and blasters worked the heading, blasting out the raw rock, along with muckers who cleared away the debris and loaded it into horse-drawn wagons; 80 feet back, a large crew excavated the shaft to its full 25-by-26-foot dimensions with hand tools and behind them another detachment installed

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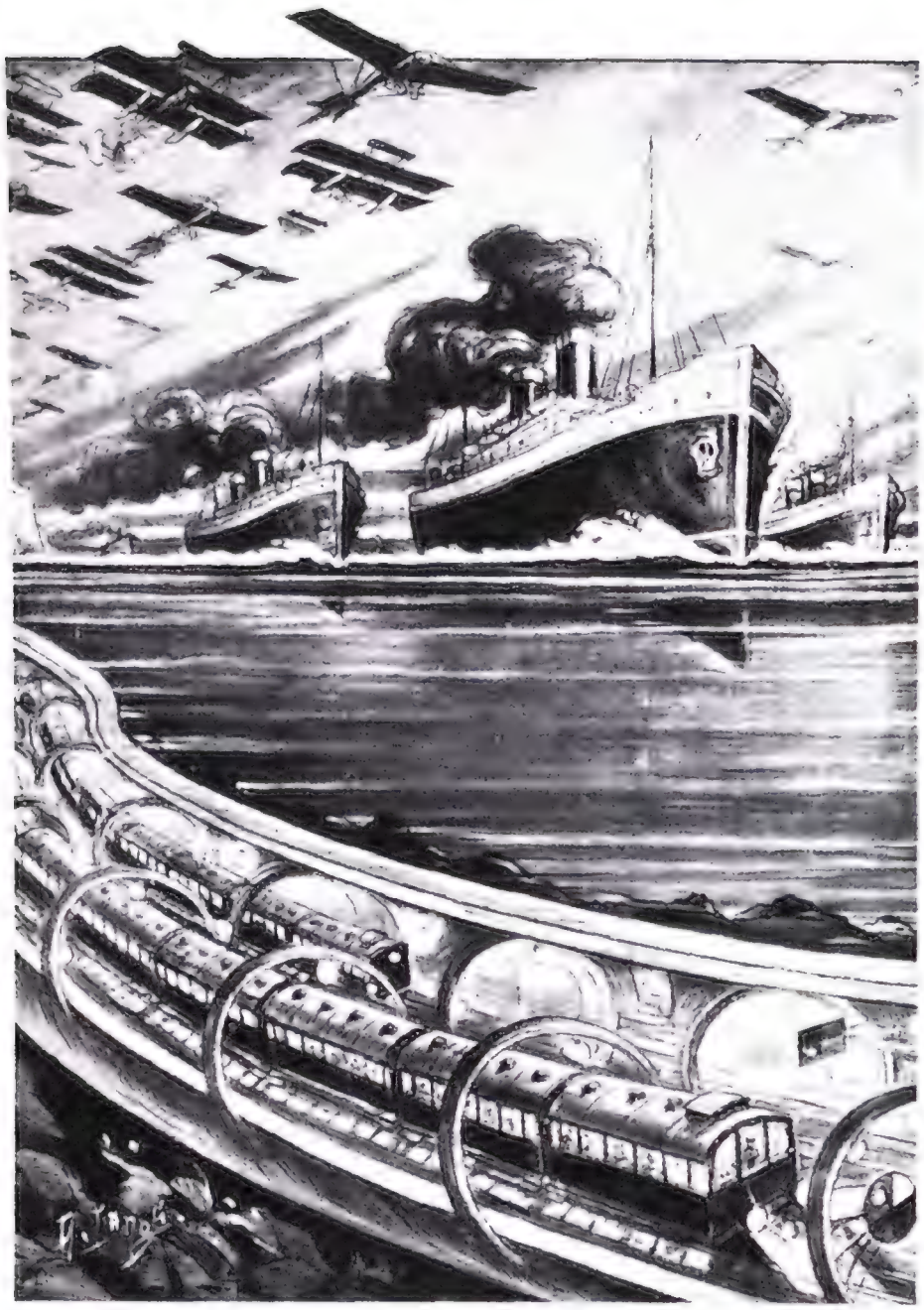

Artist's 1914 conception of a Channel tunnel was labeled "How the King May Travel to Paris in Future."

Latest Chunnel plan calls for three bores: two, 24 feet in diameter, for autotrains, and one service tunnel.

the masonry lining. The men in the rear labored in a perpetual miasma of smoke and dust. "I could not see a lamp on the opposite side," a visitor wrote. "I was in about an hour, and when I came out I spit as black as though I had dined on lampblack."

When the headings driven from the French and Italian sides linked up on Christmas Day in 1870, the surveyor's alignment measurements were found to be off by less than a foot vertically and about a foot and a half horizontally, not bad for a tunnel 40,138 feet long. At the grand opening in September 1871 some 1,500 guests seated themselves atop a pile of rubble at the south portal and dug into a meal featuring seven entrées and a dozen wines. The most prominent absentee was the man most responsible for this superb achievement, Sommeiller. As many another tunnel engineer would do in years to come, Sommeiller had worked himself to death two months earlier. He was 56. Aside from the tunnel itself, his finest legacy was the fact that only 28 of his men died building it.

The even more ambitious St. Gotthard Tunnel through the Swiss Alps, which began the following year, turned out to be a horrible example of subterranean overreaching. Encouraged by the success of Fréjus, the builders of the 9.25-mile-long St. Gotthard used all the latest techniques—dynamite, water-turbine-powered air compressors and improved, railborne rock drills—and they eventually succeeded, but at an appalling cost: 310 men dead and 877 incapacitated. No tunnel before or since has exacted such a toll in human misery. The toll on animals was worse; about 30 horses and mules died each month.

The first fatal mistake was the contract that Genoese builder Louis Favre signed with the Swiss Central Railway. Favre underbid six other contractors, promising to do the job in less time for less money. He also agreed to forfeit $1.6 million if he didn't meet the deadline. As a result he and his men were forced to labor at a pace that permitted few delays and no amenities. Favre couldn't afford unpleasant surprises; the St. Gotthard massif was full of them.

When they had pierced 2,000 feet of the mountain, drillers struck a stream that gushed out with fire-hose force at a rate of 3,000 gallons a minute. Work was frequently suspended so the tunnel could be drained, then resumed in an atmosphere that resembled an endless tropical rainstorm. Water was often a foot deep on the floor. As crews pushed forward the temperature at the tunnel headings climbed, at one point reaching 122 degrees F. Working under these conditions was so debilitating that the shifts had to be cut to five and a half hours.

An American journalist visiting the site in 1875 was aghast. The men subsisted on meager quantities of "polenta, a sort of Indian meal porridge. Meat they never taste at all. They are contented to receive their forty or fifty cents a day. . . . Every week records its disaster, either from explosions and flying rocks, falling

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And you'll not only find the Quadrifoglio unusually quick, you'll find it surprisingly nimble. With its anti-sway bars, 15″ light alloy wheels and low profile Pirelli tires taking much of the credit.

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During accident under Hudson River, men working in compressed-air compartment escape via an air lock.

Two "sandhogs" pose impassively in tunnel beneath Hudson River just before the turn of the 19th century.

timbers and masonry, or railway accidents, breaking machinery, etc." If accidents didn't get them, disease did, especially silicosis, which was later found to be caused by breathing dust from the soft magnesium silicate in which they were drilling. Dozens more died in an epidemic eventually traced to a parasitic worm in the water. Favre himself buckled under the strain and succumbed to a heart attack in 1879. He was buried beside scores of other tunnel victims in a small cemetery just outside the north portal.

The tunnel was holed through in February 1880, but it was two years later before the widening and lining were finished. The firm had to forfeit its $1.6 million and became one more casualty of the St. Gotthard Tunnel, along with Favre and the 1,187 other men who were now either dead or invalids.

At the same time that the horrors of the St. Gotthard were unfolding, the most intriguing and most endlessly discussed tunnel project in history—the proposed Chunnel under the English Channel—enjoyed the single brief interlude of genuine activity in its curious career. The idea of a 31-mile railroad tunnel connecting France and England had teased two generations of engineers in both countries. In the 1870s drilling actually began. But with a mile-long shaft already thrusting under the Channel's bed (p. 70), the British yielded to insular edginess and called a halt. "John Bull will not endanger his birthright," a leading military foe of the tube trumpeted, so that people "may cross to and fro without running the risk of seasickness."

The Chunnel plan has been dusted off and shined up periodically ever since. Early this year the British and French governments announced agreement on a privately financed, twin-tubed railroad tunnel with construction to begin in 1987 and a target completion date in 1993. Two shafts 24 feet in diameter are to penetrate the Channel's bed at a depth of 131 feet. (A third will handle ventilation and maintenance.) If, in fact, it is ever completed, special trains will carry automobiles and trucks through the tunnel, which Prime Minister Margaret Thatcher describes as a "great undertaking," though a third of her countrymen still oppose it.

By the late 19th century, the focus for tunnel engineers was beginning to shift to the United States and especially New York, where the rivers encircling Manhattan captured a tunneler's imagination and challenged his ingenuity. The first to accept the challenge was a somewhat mysterious Californian named DeWitt Clinton Haskin, who turned up in New York in the 1870s with a proposal to tunnel through the silt under the

They earned high wages, took pride in a reputation for bravery, but they were often maimed or killed.

Hudson River between Manhattan and Jersey City.

Haskin had been seized with inspiration while watching the construction of the Eads Bridge in St. Louis, in which caissons—iron boxes like diving bells filled with compressed air—protected the workmen excavating the bottom of the Mississippi. He reasoned that a similar technique could be employed in tunneling the Hudson: fill a shaft with compressed air. Workers thus could get along without the shield invented by Marc Brunel and later refined by British engineer James Henry Greathead. What they needed was an air lock, a sealed chamber with doors on both ends that would permit passage of men and materials between the pressurized work area and the open atmosphere behind it. Haskin built one.

At the outset it looked as if Haskin's idea might work. Air pressure of 17 to 35 pounds per square inch kept the water out while diggers and muckers cleared out the mud and other workmen timbered the shaft and then lined it with iron and brick. Work began on the Jersey side in 1879. By July 21, 1880, it had progressed 300 yards. Then came catastrophe and an extraordinary act of heroism.

It began with a hiss of escaping air—a leak—in the mud heading while 28 men were in the tunnel. Foreman Peter Woodland, a 35-year-old Danish immigrant, ordered a sandbag shoved in the break, but the hole abruptly widened and water and mud began pouring in as air flowed out. Timbers and iron plates crashed to the floor. The lights flickered out. Guided by Woodland, the men scrambled for the air lock. Eight made it inside before a falling piece of debris blocked the partially opened door, preventing anyone else from entering. Woodland and the other 19 men remained outside in the tunnel, in the slowly rising water.

*Silent shadowy forms in the gloom*

The air lock was designed so that a far door, which led to safety, could not be opened until the door to the heading end of the tunnel was closed, which was now impossible. Water flowing into the air lock threatened to drown them all in minutes, but there was still enough air in it to stem the flood. Woodland cooly ordered the men in the air lock to break a small window in the far door. This would let the remaining air escape. Water would then quickly fill the air lock, and Woodland and the others still outside in the tunnel would be doomed. The men inside, however, could now try to force the far door until it opened up to let them out. Woodland's decision saved the lives of the eight men in the air lock; in a few minutes all 28 would have died.

The survivors unanimously praised Woodland's desperate courage. One recalled his last glimpse of Woodland and his trapped companions: the foreman's face was just out of the water; the other men were silent shadowy forms in the gloom, with water lapping at their chests; none moved.

Haskin eventually abandoned the risky project. But a company organized by William McAdoo, a Georgian who later became a Cabinet officer and Presidential candidate, resumed the attack in 1902 with shields driving in both directions. McAdoo's men were forced to blast when they ran into an unexpected ledge of rock, but with this obstacle surmounted, the two headings met in 1904 and McAdoo donned oilskins to become the Hudson's first underwater bank-to-bank pedestrian. *World's Work* magazine proudly reported in 1906 that New York could now be described as "a body of land surrounded by tunnels." Three one-way shafts beneath the Hudson and two under the Harlem River were already holed through, three more Hudson

tubes were building. Eight separate tunnels were under construction beneath the East River.

The material underlying the East River was not silt but rock, thus blasting was necessary. A company drilling a bore for gas mains first penetrated beneath the river in the 1890s and serious trouble quickly developed. Compressed air was piped in when the drillers hit soft rock, but because of the depth of the shaft the pressure required was as much as 48 pounds per square inch, more than any tunnel workers had ever tolerated. Despite use of decompression chambers, so many men died from the effect of the "bends," caused by nitrogen bubbles in the blood, that a newspaper labeled the gas tunnel "the black hole of death." One sandhog, as New York tunnelers were called, compared the bends to "a jumping toothache and the worst kind of rheumatism." The pain was excruciating. An appalling 25 percent of New York's tunnel workers would die of the bends.

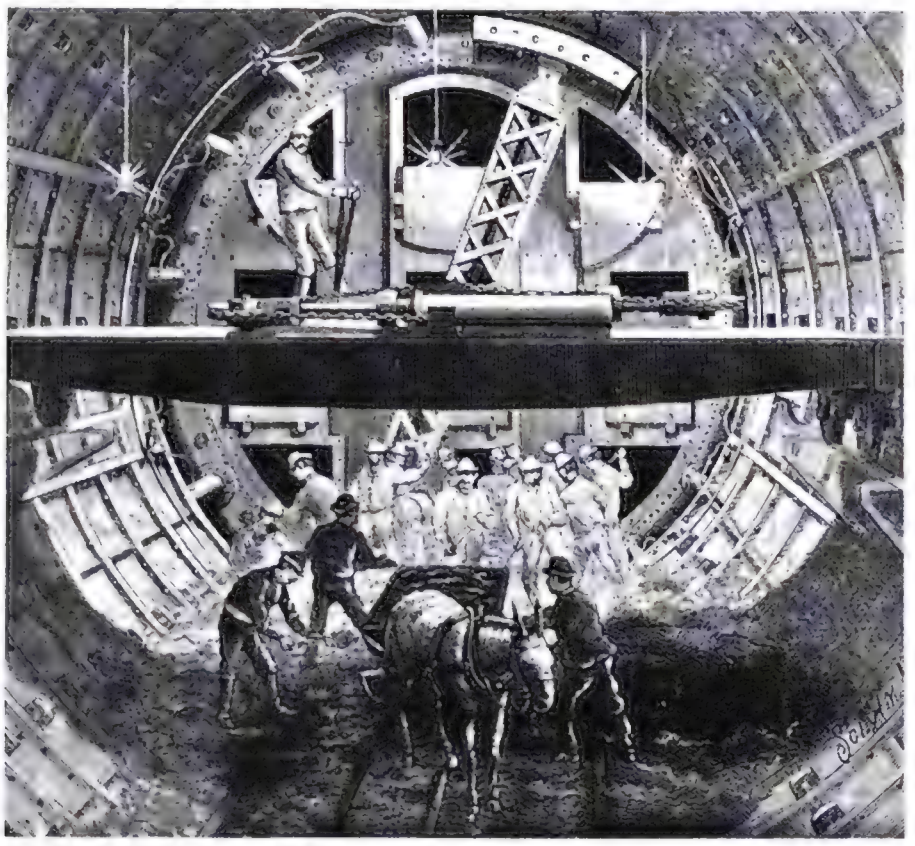
Nevertheless the sandhogs still showed up for work every day, exchanging risk and pain for relatively high pay and the satisfaction of belonging to an elite work force. There were a dozen ways to die on a tunnel job, but it was also true that fortune could sometimes smile in peculiar ways. In 1905 a blast of air pressure blew through a weak spot in the roof of an East River shaft, propelling workman Richard Creedon through 17 feet of silt and ten feet of river, finally shooting him up out of the water in a cloud of mud like some flailing four-limbed projectile. Pulled unhurt from the river, Creedon shrugged off his bizarre flight with characteristic sandhog understatement. "It didn't amount to such a lot," he told a newsman. "Before I came down I had a fine view of the city."

By the time New York's maze of underground and underwater subways was completed, the railway era was ending and the age of the automobile had dawned. Though London was again the pioneer with two short auto tunnels under the Thames, New York's Holland Tunnel—appropriately in the car-crazed United States—was the first car tunnel on a grand scale. Opened in 1927, the twin-tube Holland became a splendid prototype for the dozens of auto tunnels to follow.

The most formidable problem for chief engineer Clifford Holland, a soft-spoken, precise Harvard graduate, was the lethal carbon monoxide present in automobile exhaust. Holland devised a ventilation system powered by 84 enormous fans in buildings at either end of the tunnel. The fans blew fresh air through ducts beneath the tunnel's roadway; the air was then circulated through the tunnel and sucked out through other ducts in the roof. Four shields were needed to dig the 29-foot-wide shafts that extended 8,463 feet from Manhattan to New Jersey. Novel safety precautions for the sandhogs included watertight bulkheads that could shut off a flooded section in the manner of sealed-off holds on a ship.

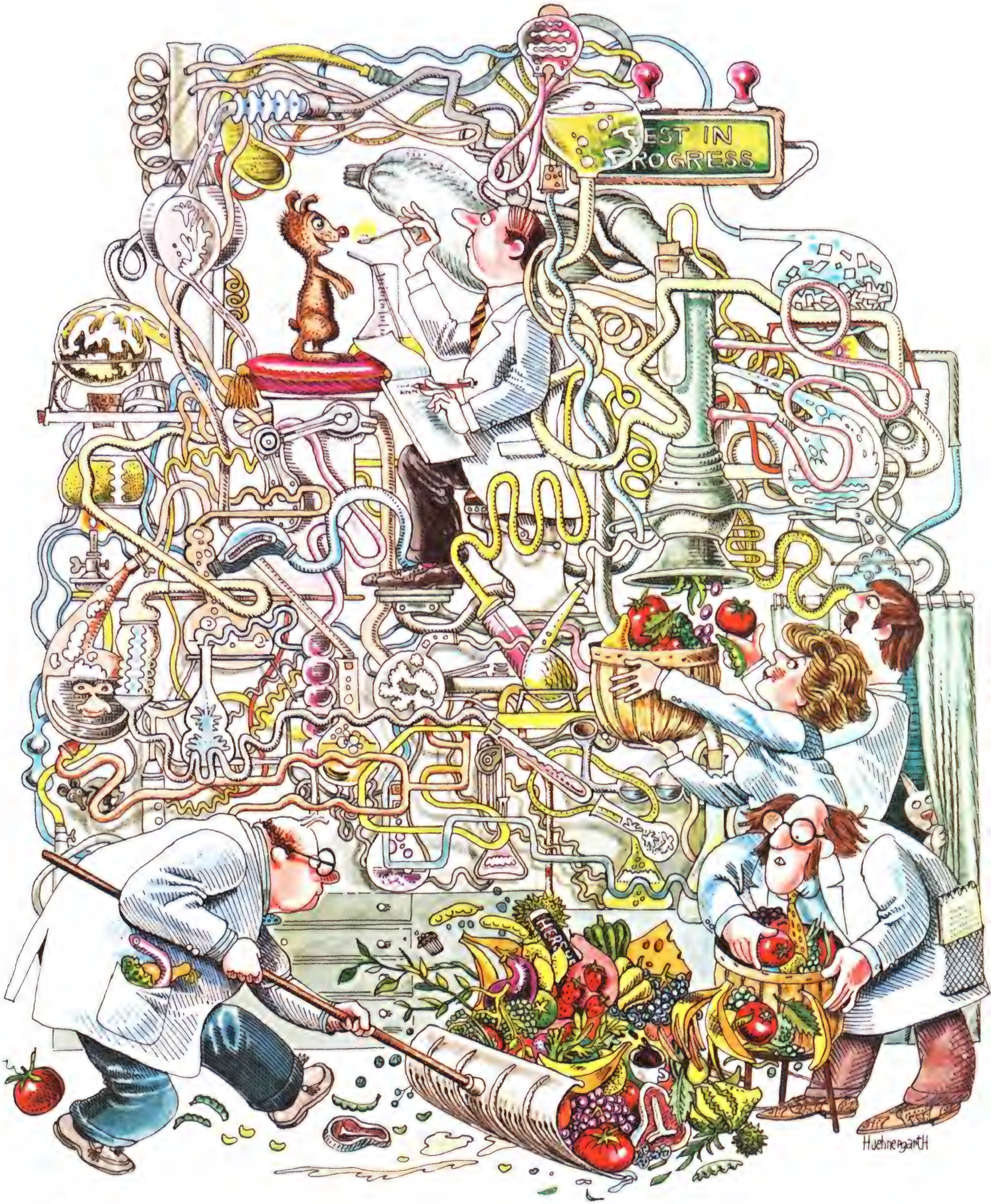
Holland drove himself at such a feverish pace that he fell ill and died of heart disease at age 41, just two days before the first of the two tubes was holed through in 1924. Like Sommeiller and Favre, Holland, whose name was given to his finest achievement, was a victim of his obsession with tunneling. Thirteen other men died before the tunnel was completed in 1927 under the direction of Norwegian-born Ole Singstad.

On the day of the tunnel's formal opening, Singstad walked alone into one of the tubes from the Manhattan side. Cars were barred from entering for several hours yet, but Singstad heard a peculiar shuffling sound that grew louder and louder. Excited, he climbed onto an elevated walkway and peered deep into the tile-walled shaft. Abruptly a line of pedestrians appeared, the vanguard of 20,000 who were celebrating the new wonder in the same spirit that Londoners exhibited at the opening of the Thames Tunnel in 1843. They sang, they shouted and admired their echoes, they shook hands solemnly at the sign marking the New York-New Jersey line. When the parade was over, the first cars were allowed in. The first collision was reported one hour and 15 minutes later.



Protected by special sheet-iron shield at head of tunnel, sandhogs load dirt into horse-drawn trolley.

Worker stands in Japan's new Seikan Tunnel. Finished, it will be the world's longest—more than 33 miles.




The scientists who create synthetic flavors must first analyze natural ones to find the key chemicals.

Coffee, for example, has more than 800 different flavor compounds, only a few of which are essential.

*By Ellen Ruppel Shell*

# Chemists whip up a tasty mess of artificial flavors

*Analyzing compounds we like and making improvements on nature, flavorists mix artistry and science to please our palates*

Charles Wiener's laboratory seems, at first encounter, to be a rather sterile place, with the usual array of spotless glass tubing, stainless-steel sinks, and row after row of tightly stoppered bottles all lit by a glaring slash of neon. But upon entering the lab, one is immediately struck by an aroma that is totally at odds with the setting—the earthy smell of roasted peanuts punctuated with undertones of just-ripe bananas all wrapped in an overlay of blueberry jam. There is not a morsel of food in sight.

"Try some," Wiener urges, spooning up something thick and purple from a clear-glass jar. One hesitates—this is, after all, a laboratory, not grandmother's kitchen. But Wiener, a robust and jovial man, insists and the glop is duly ingested. It is delicious. "I think that is the best blueberry flavor that's ever been made," he says, beaming triumphantly. "And there's not a scrap of blueberry in it."

Wiener is a flavorist, one of about 100 experts nationwide who are entrusted with creating the thousands of flavors that go into our food, drink, cigarettes, mouthwash and toothpaste. Like all flavorists, he has the nose of a bloodhound and the tastes of an oenophile. He also has a PhD in biochemistry. He got into the business, he says, simply because he loves to eat. That was 15 years ago. Today he is head flavorist at International Flavors & Fragrances Inc. (IFF), the largest producer of flavorings in the world.

Becoming a flavorist is nothing like becoming a doctor or plumber or teacher. For one thing, few have ever heard of the specialty. It is not and cannot be taught in school. Flavorists must have an acute sense of taste and smell, a flair for the artistic and a technical inclination. Most begin their careers doing something unexotic like organic chemistry. Wiener got his start at an oil company, where he worked on wax formulations. An advertisement in a professional journal alerted him to the field of flavorings and sent him, PhD and all, scurrying to apprentice himself to Ernest Pollack, now retired but still considered one of the foremost flavorists in the world. Five years later he emerged a full-fledged flavorist.

"A lot of flavorists never mature, they are technicians rather than artists," Wiener says. "There are only a handful of people in the world who can create flavors from scratch and many of them are retired. It's something of a dying art."

Wiener's windowless basement laboratory is stocked floor to ceiling with hundreds of potions and powders that he likens to the colors on an artist's palette. There is jasmine and rose oil from Bulgaria, cold-pressed lime oil from Sicily, blue chamomile oil from Morocco, cassia oil from China. There are roots, leaves, dried berries and seeds from every corner of the globe. It would seem that alchemy is practiced here, and in a sense it is. For creating flavors is no mere matter of squeezing a little juice from, say, a raspberry or mashing its pulp into a seedy essence. Flavors are delicate, elusive things that seem almost to evaporate with handling. The trick is to tease out from the hundreds of compounds that make up a raspberry those few precious elements that are essential to its flavor, then concentrate these compounds into a sample with a good deal more zest than that found in the natural berry.

### *No machine can judge flavor*

"Nature has a way of decoying its secrets with unnecessary ingredients," Wiener says, chuckling. Coffee, for instance, contains more than 800 different flavor compounds, only a fraction of which are absolutely essential to its characteristic flavor. To identify the essential flavor compounds in a food, chemists use a gas chromatograph, a machine that separates the food into its basic chemical constituents. But no machine can make judgments about which of these hundreds of chemicals contribute to the food's flavor—this is where the artistry comes in. Each of the chemicals is either smelled or tasted by the flavorist to determine whether it is crucial to the food's distinctive flavor. Those chemicals that are deemed critical are then precisely recombined into a facsimile of the natural flavor.

Identifying all of these essential flavor compounds can, in some cases, be like trying to track down a particular grain of sand on a broad stretch of beach. Some

*Illustrations by John Huehnergarth*

At Monell Chemical Senses Center, taste researchers can draw inspiration from sculptured nose and mouth.

flavor chemicals occur in such small concentrations—parts per trillion—that they cannot be detected in laboratory samples. To detect these tiny concentrations of flavor particles scientists must sort through thousands of pounds of material. To do this they go on location—to jam, coffee or chocolate factories where tons of fruit and beans are processed every day. They rig up enormous contraptions to capture the aroma of the roasting beans or steaming berries, which they then analyze in hopes of discovering the tiny traces of chemicals that are so important to the distinctive flavors of the foods.

They don't always succeed—there are no widely accepted artificial coffee or chocolate flavors, nor are there good synthetic substitutes for strawberry or roasted meat. These foods are the Holy Grail of the flavor industry. Their flavor is not characterized by one or two or even half a dozen compounds, but by an orchestra of substances that, acting in concert, create an irreproducible (so far) chemical symphony. Some taste experts theorize that it is the very complexity of these flavors that makes them so appealing: the bitter/sweet taste of chocolate and the sour/sweet taste of strawberry, combined with their multitude of olfactory notes, make them enduring favorites.

But these foods are the exception. Most flavors have been characterized and mimicked so precisely in the laboratory that it has become nearly impossible to distinguish the fabricated from the original, says IFF research director Ira Katz. And some very popular flavors do not even exist outside of their synthetic renditions because they have no natural counterparts at all. For example, cola nuts taste nothing like the soft drink that bears their name. Cola flavor is a purely synthetic construct of natural ingredients, a "fantasy flavor" in the words of Katz. Were it not for the ingenuity of the legendary Southern pharmacist who whipped up the first batch of Coca-Cola 100 years ago, cola flavor might not exist.

*Entirely new flavors are a rarity*

But the invention of entirely novel flavors like cola and Dr. Pepper is extremely rare. Most of the work done by the flavor industry involves not the creation of new flavors but the duplication of established ones to suit the world's millions of different tastes. Hungarians like the flavor of paprika while Indonesians enjoy the taste of the fruit of the durian tree, a prickly fruit whose smell, to the Western nose, inspires the unfortunate impression of expired skunk. Latin Americans like the nutty flavor of cashew, and Indians favor ghee, the flavor of clarified butter, sometimes from yak or buffalo milk.

"Orange is by far the most favored taste internationally," says Al Clausi, senior vice president and chief re-

To detect the constituents of complex flavors, huge contraptions trap aromas at food-processing plants.

search officer of General Foods Corporation, one of the largest food manufacturers in the world. "But there are some unique flavors preferred in certain regions of the world. For example, there is a flavor in Peru called *chicha morada*—it's very hard to describe and Peru is the only country that I know of that sells it. In Mexico there's 'Jamaica,' a flower extract with a sort of tropical-fruit flavor that's very popular in beverages and gelatin desserts."

But while every culture has its favorites, flavor preference is not a genetically inherited characteristic. Several scientists around the world have devoted their careers to studying how taste preferences are acquired, and some have done at least part of their work at Monell Chemical Senses Center. This is a research institution that is loosely affiliated with the University of Pennsylvania.

Located in four floors of a rather stodgy office building that sits squarely across the Schuylkill River from downtown Philadelphia, Monell would be completely undistinguished were it not for the enormous gilded sculpture of a human nose and mouth that perches just in front of its entrance. Inside, the main order of business is made immediately obvious by the pervasive series of odors wafting through the halls. The smell varies with the particular floor and hallway one happens to be walking through, but the overall olfactory effect is that of a large cage in which a family of not entirely hygienic hamsters is baking chocolate chip cookies.

Gary Beauchamp, a psychologist and associate at Monell, has neither pets nor cookies in his office, though he does have an enormous photograph of a guinea pig on his door. Through studies of these animals and of humans he has learned a great deal about taste acquisition. People, he says, are born with only a few taste prejudices—for example, a preference for sweet and a dislike of bitter. There is a very good reason for this. In the wild, sweet plants are generally nutritious while bitter ones are often poisonous, so a built-in sweet preference and bitter aversion has helped the species survive. But there is little evidence that children are born with any other inherent preferences. In fact, humans and most other animals are neophobic about food—they distrust and dislike any food until they have grown accustomed to it. Sheer experience has made many parents painfully aware of this phenomenon; that first loving spoonful of cereal shoveled into junior's mouth is often returned less lovingly and far more emphatically into the dead center of mother's eye. But the clever parent quickly learns to disguise new foods in old, familiar ones. Sweet foods like applesauce make particularly effective carriers for small bits of, say, strained peas. The infant's natural predilection for sweet will override its distrust of the new food, and the amount of sweet taste can be slowly diminished until the baby will, in some lucky cases, actually eat its strained peas straight.

Humans are born neophobic about food, disliking new tastes, but a child adopts the preferences of parents.

*Ellen Shell is a frequent contributor to* SMITHSONIAN. *She wrote on Keeneland's horse auction in April.*

Some marketers ruefully suspect that people change marriage partners more readily than eating habits.

When discussing flavor preferences, researchers emphasize that it is important to explain how taste and olfaction relate to flavor. Some scientists believe that humans can distinguish only four tastes: salt, sweet, bitter and sour. Our experience of food relies not on the taste buds alone but on a combination of taste, smell, tactile and temperature perception.

Children tend to adopt the food preferences of their parents not because they inherit them but simply because they are exposed to the foods that their parents eat. A vivid example of this is the yen for chili peppers exhibited in young children in Mexico. These peppers contain capsaicin, an irritant. Capsaicin causes pain in the mouth, and the feeling of burning heat. Small children of every descent wisely avoid eating chili peppers and anything else that causes them pain. But at about the age of five or six, Mexican youngsters begin to like the effect and start piling their tortillas with the fiery vegetable. This, researchers say, is a prime illustration of flavor preferences as learned behavior. No one is born with a taste for pain; we have to learn to love it.

"Humans can learn to like anything, that's why we are such a successful species," says Jeannette Desor, an experimental psychologist who trained at Monell, Yale and Cornell and who now works as a research scientist for General Foods. "You can drop humans anywhere and they'll thrive—only the rat does as well. But we do acquire preferences for things that we are exposed to and by the time we are adults these preferences can be quite strong."

The food industry is well aware of how difficult it is to change long-entrenched flavor preferences—some who have tried say that people will more willingly change marriage partners than eating habits. Americans, for example, are very fond of meat, a costly item in the world market basket. Soy products, which are widely favored in the Orient, can be equally nourishing and are a lot cheaper to produce than meat. But when the food industry first introduced soy burgers into this country more than a decade ago, they failed miserably. Soybean flavor has been difficult to sell here, but recent sales of new soy-protein products, such as frozen desserts, have been brisk.

To monitor products aimed at the "public taste," major food manufacturers carefully select and train professionals to sample and describe new products before they are brought to the open market. Lydia Ohan, a junior scientist at General Foods, trained for three months to learn to differentiate between smoky and musty coffee and to distinguish ten variations on the theme of orange gelatin. Unlike flavorists, these individuals are not selected for an extraordinary sense of taste or smell. Their job is to represent the general public, to react to a product the way the majority of consumers would, but to learn to describe their reactions precisely. "It's something like learning a foreign language," Ohan says. "We don't say what our preferences are—we are used like analytic instruments to compare each food to an accepted standard and judge how close it comes to that standard." If it is determined that a particular segment of the American public likes its coffee mild and mellow, coffee geared toward that market doesn't leave the factory until the taster judges it to be mild and mellow. Only then is the coffee ready for market testing, at which time volunteers from outside the company are asked whether they like the taste.

*American tastes are a moving target*

American tastes have become something of a moving target in the past 15 years and food companies are scrambling to keep up with them. In the late 1950s and early '60s, consumers wanted easy-to-prepare foods that would fill their families' stomachs without breaking their budgets. In the post-Sputnik era, the public's awe of technology translated into a trust in synthesized foods. Not many people worried about artificial flavorings or colors, and the biggest sellers included ground-beef extenders, macaroni-and-cheese mixes, instant mashed potatoes, and an array of other food products that never had any pretense of being "natural." Those days are gone.

"More Americans than ever believe that they truly are what they eat," says General Foods' Al Clausi. "They want freshness, lightness and, most of all, they want naturalness. This pull from the marketplace has pushed science."

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While American consumers have grown leery of artificial flavorings, their experience with artificially flavored foods has caused them to demand a lot of taste. They won't accept an "all-natural" soda with only a faint hint of cherries, or an ice cream vaguely reminiscent of bananas. They want a big, robust taste but without the chemicals—and this poses an enormous challenge to the flavor scientist.

"Most natural flavors simply do not stack up to their best synthetic counterparts," says Clausi. "In blind tests people almost invariably prefer synthetic flavors because natural flavors lose some of their characteristic taste when they are extracted from their source by heat or other methods."

So while people believe they want natural flavors, they often actually prefer synthetic ones. Robert A. Kluter, a senior food technologist at the U.S. Army Research and Development Center in Natick, Massachusetts, has tested the taste preference of military personnel for more than 15 years. He says that most recruits prefer diluted orange juice concentrate to the fresh-squeezed variety and would rather have an artificially flavored fast-food shake and burger than a carefully seasoned stew. "In the last ten years or so I've seen a change in what young people say they prefer," he says. "They want food with much more flavor—more spicy and smoked foods, more zestiness." For this reason, Tabasco pepper sauce (SMITHSONIAN, May 1984) is now standard issue for soldiers out in the field. Kluter says the soldiers pour it on everything—from their morning eggs to their evening chipped beef. The object, he explains, is to fill the mouth with lots of flavor, even to the point of pain.

Characteristic aromas can be captured and condensed in products that will give foods heightened appeal.

*Americans are reluctant chewers*

"Many overweight Americans tend not to expend a lot of energy in chewing food," explains Susan Schiffman, a professor of psychology at Duke University Medical Center and a leading taste researcher. "They tend to want the biggest possible 'taste' impact with the least amount of energy output." This means they want a lot of flavor, but aren't always willing to work for it by either cooking, seasoning or even chewing food carefully. "Fast food is popular because it takes very little energy to consume and the high fat content carries flavor," Schiffman says.

Food products have traditionally provided high flavor impact through the magic of organic chemistry. This is not a recent phenomenon—late-19th-century scientists worked out schemes to chemically create cheap synthetic versions of costly spices like cinnamon, clove and vanilla. Before these chemical formulations were worked out and perfected, the major source of flavoring was the simple extraction of essential oils from foods. But this is a very expensive and time-consuming process—it takes 4,400 pounds of cocoa beans, for example, to get less than an ounce of cocoa oil. But recent advances in biotechnology have made it possible to derive "natural" flavors using methods that would no doubt leave Mother Nature dumbfounded.

One long-established approach is to get microorganisms such as mold, yeast and bacteria to churn out the flavors as waste products. Fermentation is one well-established version of this technique; yeast converts sugar to alcohol and carbon dioxide, thereby changing grape juice into wine. Cheeses are aged in a similar, albeit less direct fashion; mold feeds on the milk, producing enzymes that change a relatively flavorless mass into a creamy Camembert or Cheddar.

Scientists are now using different techniques to induce microorganisms to produce the chemical building blocks of flavors. Milton Manowitz, vice president of research and development of Givaudan Corporation, a Swiss-based flavor and fragrance manufacturer,

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"Super" produce brings to mind song about "eggplant that ate Chicago," but idea is extra flavor, not size.

says that the components of many meat flavors can be formed by microorganisms growing in a soup of natural products unrelated to meat. "This technique is rather expensive, but it is desirable because it is a natural process," Manowitz says.

Of course, getting the flavor directly from the fruit or vegetable would be even more desirable. The song lyric "The eggplant that ate Chicago" comes to mind when scientists describe just how they plan to engineer "super" produce for use in the flavoring of other foods. But this image is quickly dispelled by the assurance that these fruits and vegetables will not be superbig but superflavored—so flavorful, in fact, that they will have too much taste to be eaten as they are.

DNAP Corporation, a firm that specializes in agricultural biotechnology, is at the cutting edge of fruit and vegetable design. Research manager Robert Whitaker says that a supertomato has already been designed for use in the making of soup and purees. To get this supertomato, DNAP scientists use tissue-culture techniques, which entail growing many plants from the body cells of a single plant. This saves the time it normally takes plants to reproduce and allows scientists to select certain desired characteristics, in this case strong flavor, without having to worry about variation induced by the crossbreeding of plants.

"We'd also like to get plant cells in culture to make flavors, just like bacteria in culture can produce antibiotics," Whitaker says. "But trying to pin down the genes that code for flavors is very, very difficult. Flavors are multichemical—if a flavor contains 200 different chemicals, it would take at least 200 genes to reproduce it, more likely a multiple of 200. The genetics of flavor is very complex and it has not been completely worked out. Research in this area is just beginning."

*Trapping odors that go out the chimney*

But not all natural flavors need be the product of such exotic technologies. One tried-and-true method is to trap flavors as they literally go out the chimney. "Ever go by a bakery and take a deep breath?" asks Warren Wong, technical director at Firmenich, an international flavor company based in Princeton, New Jersey. "Or smell the exhaust coming out of a candy factory?" Those odors, he says, can be captured and condensed from these processes and used as flavor bases for products such as bread.

Ironically, the flavor that industry is most eager to mimic is cheap and widely available in its natural state, as well as a cinch to produce in the laboratory. That flavor, or taste, as it is more correctly called since it has no smell, is salt—a taste that, according to Monell psychologist Gary Beauchamp, humans develop a preference for by the age of four months. The problem is that sodium, one of table salt's two components, has been implicated as a contributor to high blood pressure, and the Surgeon General recommends that most Americans cut back on it. But we like salty taste and are loath to give it up. Low-salt soups, put on the market several years ago, proved a dismal failure.

"Soup companies would like to offer consumers something other than salty water; they don't want people getting high blood pressure, but people by their very nature like the taste of salt," Beauchamp says.

Finding an acceptable sodium-free salt substitute has been difficult partly because scientists aren't even sure how humans perceive the salt taste. For years it's been known that salt receptors on the tongue's surface pick up and transmit salt sensation. But scientists at several research institutions recently discovered that the sodium in salt is not just passively perceived on the surface of the tongue, but is also transported by special channels through the membrane and into the body of cells on the tongue.

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standing the taste reception of salt," says General Foods' Jeannette Desor. "Once we have a clear understanding of the entire process of how salt is perceived, we might then be able to find a new way to synthesize a perfect substitute."

Morley R. Kare, director of Monell, says that many questions of taste are still unresolved because the science is so new. "This field is very backward," he says. "We don't really understand the mechanism of taste, partly because there are so few scientists working in the field and partly because the questions themselves are so tough."

One of the biggest and most damaging misconceptions, Kare says, is that the sense of taste fades with age. "If you're healthy and active, your tastes don't really change," he says. "Taste buds regenerate about every ten or 11 days; the elderly lose a few but not enough to matter. Go to a meeting of any wine-and-food society and you'll see an awful lot of old people who haven't lost their sense of taste."

Duke researcher Susan Schiffman says that the elderly do lose some sense of taste, but more of their sensory loss is due to a decreased sense of smell. To combat this, Schiffman has worked with the flavor industry to create a number of powders and sprays that enhance the flavor of various foods.

"Thirty percent of the elderly experience nutritional difficulties," Schiffman says. "They don't get enough vitamins, minerals or calories." But foods sprinkled with tuna, olive oil, tomato or mashed-potato flavor spark elderly appetites and encourage them to eat a better balance of foods. These flavorings are not yet commercially available, Schiffman says, because industry hesitates to target any product specifically to older customers. "The problem is that a 72-year-old shopper will look at a product like this and will say to himself, 'Oh, something for my mother,'" Schiffman laughs. "Nobody likes to think of himself as old, and industry knows it."

Regardless of the findings and breakthroughs of psychologists, chemists and flavorists, industry can only respond to, not dictate, public demand. And what the American public wants now, says William F. Zick, vice president for marketing in the flavor division of International Flavors & Fragrances, is a salt-free salt flavor, a fat-free fat flavor and a no-calorie sweetener that tastes just like sugar. We'd also like a no-alcohol beverage with all the punch of good whisky, and a no-tar, no-nicotine cigarette just like the real McCoy. "It would be nice to have a really good chocolate flavor, too," Zick says wistfully. The world's flavorists have their work cut out for them.

In food industry, a flavorist's place is in the lab as companies keep an eye on changing public tastes.

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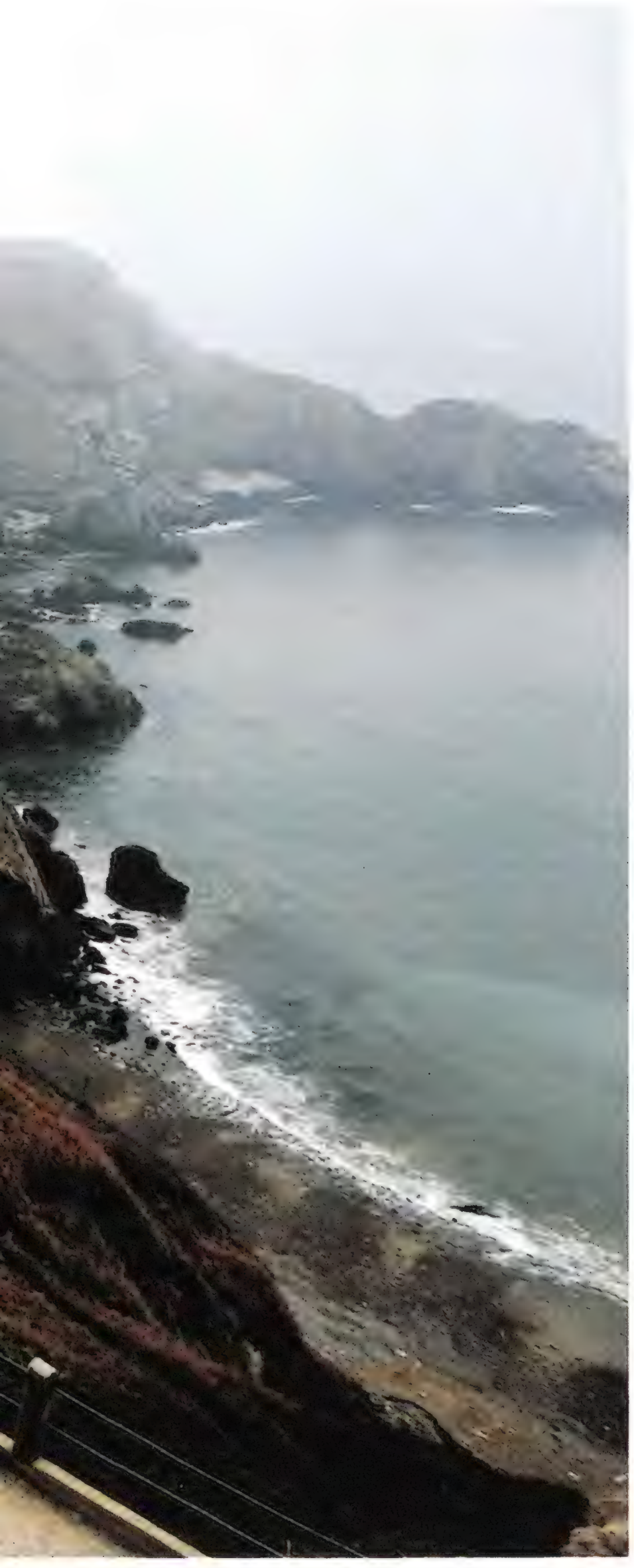

*By Timothy Foote*

# How to keep the 20th century mostly at bay

*The tiny island of Sark still carries on with low-budget feudalism, dislike of cars and its mixed memories of a Great Dame*

The place is a Roof Garden of Eden, perched on a fortress of stone.

Approaching it across the English Channel, voyagers first see black cormorants grouped on outlying reefs and rocks, looking—as a local wit has put it—"like members of the clergy who have agreed, with bad grace, to differ." Then the island itself looms up, jagged cliffs rising 200 feet out of the water.

Sark is tiny—three and a half miles long by one and a half wide. Local tides are huge (up to 40 feet), with murderous currents that curl every which way around the island. Cliffs and headlands have been so cut into that its actual perimeter is 42 miles around. For hundreds of years the only harbor was a minuscule cove called Creux, and even from there the early islanders had to blast a tunnel through solid rock with black powder to get up onto the island from their boats. That was in 1588, the year of the Spanish Armada.

Most visitors now land at nearby Maseline—not a harbor at all, but a long seawall. Because of the tide's height, Maseline is festooned with 40-foot necklaces of rubber tires that hang down to bump and grind between the stone and the steel sides of docking boats. In certain winds it is impossible to land. The same is true of thick weather, which is why islanders have always

Carriage navigates La Coupée, a steep isthmus that links Sark with Little Sark and drops 250 feet to sea.

*Color photographs by Robert Rattner*

Present Seigneur, Michael Beaumont, an aeronautical engineer, inherited post from grandmother in 1974. In Chief Pleas, the island's feudal parliament, he sits with Seneschal (under the Queen) and other officers for the first picture of Pleas allowed in past 50 years.

forbidden the killing of sea gulls. In heavy fog, the birds' cries warn sailors of nearby land.

But once safe ashore and up the curving 300-yard valley that leads to the island's top, a modern visitor finds a whitewashed pub, then a dusty crossroads where carriages wait for hire. From there, the day's boatloads of tourists are turned loose down a short unpaved street, ironically known as "the Avenue," along which Sark's few shops cluster. There are some thunderous slow tractors for "haulage" and farming, but cars and trucks are banned. Portable radios cannot be played outdoors. Sark does not permit planes. It has no smog, no crime worth mentioning, no labor unions, no unemployment and, above all, no income tax. No movie house, either. At first it strikes one as part Walt Disney movie set, part land that time forgot.

But opinions differ. "If I had to stay here more than a week I'd go crazy," a young English filmmaker tells me. "There's nothing to do but drink." A young woman, also from England, with heavy green eye makeup, disagrees. "When I go to Guernsey [which has cars and big hotels] the noise destroys me. I can't wait to get back." Another visitor tells me she once got romantically involved with an island man. "I finally told him I couldn't ever live here. But with them, you know, it's like 'I've been to London and I didn't like it.' He said, 'Do you know a prettier place?' "

Content in the absence of cars and transistors, you bump along on a rented bike, or sit in an antique carriage behind a clopping horse. The quiet lanes and roads are unpaved, smooth, mostly narrow, some sunk deep in ruts created by centuries of hedging. The low-slung houses are built of ancient gray stone, with kitchen gardens behind, and now and then old enough to have little stone projections from the chimneys—for passing witches to land on. Gentle slopes and elevations provide views stretching away to the rim of the world so that all you see is the green of fields and blue of distant sky.

On blustery days wind-fat shirts will be jigging on clotheslines, and at each big break in the hedges a sudden gust buffets a bike broadside for an unsettling second or two. At such times it is hard not to wonder what Sark must be like in winter. The thought is likely to recur near La Coupée, the spectacular isthmus that links Sark with Little Sark. La Coupée is scarcely more than a buggy's breadth wide. On one side it drops 250 feet straight down. Years ago, before there were railings, children on their way to school from Little Sark in winter sometimes had to crawl across on hands and knees to keep from being blown off into the sea.

But when the days are soft, it is easy to find yourself listening to the island's silence. Victorian-looking cows chew solemnly and gaze into the middle distance in fields fairy-book rich with buttercups and corn marigolds. Maybe *that's* why the island cream is so yellow. All sensible "trippers" stop for what is known as a "Sark Cream Tea." You slather fresh scones with that thick buttercup-colored cream (plus blackberry jam), gulp tea and think yourself transported into some 19th-century country village.

Falling under the spell of Sark today, it is impossible not to wonder what the island's future fate will be. For Sark is clearly a unique and vulnerable relic. Also some kind of test case for all small, beautiful islands (Martha's Vineyard comes to mind) now threatened by tourism and the greed of realtors. Larger Channel Islands like Guernsey and Jersey gave their names to cows and

sweaters, and are now pleasantly suburbanized resorts. Sark is famous for holding the 20th century at bay.

The island is the only self-governing, feudal fiefdom in the Western world. It is presided over by a Seigneur, who still has quite a few *droits de seigneur*. But it is governed locally by a kind of combined Parliament and House of Lords, known as Chief Pleas. (One gets an idea of this body's range of concern by learning that in 1974, when Pleas finally hammered out a Married Women's Rights law, it also rejected, after hot debate, a proposal to raise the bounty paid on rabbits.)

Day to day the island is run by a Seneschal who acts as a kind of Prime Minister, presiding over the Seneschal's Court with help from a Prévôt, a Greffier (clerk and treasurer) and a Connétable (who is a bit like a constable and road commissioner combined). It was not until 1922 that nonlandowners won the right to elect 12 deputies to Chief Pleas. Until recently Sark spoke a French patois. Native-born folk still think of "the English" as outsiders. Yet for more than 400 years, the Seigneur of Sark has owed his fealty directly to the English Crown.

Many of Sark's persisting offices, laws and customs came directly from feudal Normandy, only 25 miles away as the cormorant flies (England is 80; see map on page 102). They go back, in fact, to the savage Northmen who took what became Normandy in the 900s, wresting a duchy from a series of weak French kings.

*Timothy Foote is on* SMITHSONIAN*'s Board of Editors. He recently wrote about Rudyard Kipling.*

The first Viking lord of Normandy (911-927) was fierce Duke Rollo. In Sark, Rollo is no remote connection. Consider, for instance, something called *Le Clameur de Haro*, a kind of do-it-yourself injunction that Sarkees have a right to invoke. If you think someone is encroaching on your land you can confront the offender and shout "*Haro, Haro, Haro! A l'aide mon Prince, on me fait tort.*" The fellow who is doing you wrong must then cease and desist and the issue goes into an elaborate litigation. The *Clameur de Haro* was raised just last year when a landholder stopped a new neighbor from cutting back a hedge on some land they both claimed.

And what has all this to do with Duke Rollo? *Haro* has been thought to be a contraction of "*Ha Rollo!*" The aid called for was originally Rollo's aid.

Sarkees today would be reading Descartes, going to a lycée and suffering the supervision of bureaucrats in far-off Paris if Duke Rollo's ambitious scion, William, Duke of Normandy, had not taken England in 1066. Or if William's hapless great-great-grandson, England's King John (Lackland), having lost William's Norman dukedom in 1204, hadn't held on to the islands and established a remarkable administrative precedent. The islands now owed him fealty, not as Duke of Normandy but as King of England. Yet John decreed that whatever Anglo-Norman forms might evolve in England, the islands could stick to feudal Norman ways.

France never did get Sark back—at least for long. Despite centuries of raids, plagues and skirmishes, the 100 Years War, periods when the island was overrun by

*Keeping the 20th century at bay*

Dame of Sark for 47 years, Sibyl Hathaway needed permit from Pleas for an electric car she got at age 78.

The seat of Sark's ruling family is La Seigneurie, a 12-bedroom mansion with an Elizabethan fireplace.

pirates or lay abandoned between the two countries, it would become what it is today, a curious mixture —English in loyalties, Norman French in custom.

It was to forestall France, though, that in 1565 Queen Elizabeth I granted the then temporarily desolate island as fief to Helier de Carteret, of St. Ouen in nearby Jersey. The whole of Sark, along with a marvelous list of feudal rights (to such things as *poulage, paunage, gravage,* oblations and escheats), would be his if he could settle it and muster in its defense a force of 40 men with muskets.

Seigneur de Carteret also had to pay the Queen one-twentieth of a knight's annual service fee, which at the time came to about 50 sols. He recruited venturesome tenants and made homesteads for them by dividing the island's 1,270 most tillable acres into 40 gerrymanderlike *tenements* so that each would have a bit of coast to defend. In return for land, Sir Helier's tenants owed him a tenth of what they grew, plus a chicken a year for every chimney on their houses (*poulage*) and eventually a *corvée* of annual public work

Formal gardens, greatly expanded by the Dame, can be seen by island visitors for entry fee of 25 pence.

and a thirteenth part (*treizième*) of the price of any *tenement* purchased. The Seigneur could not sell his fiefdom without approval from the Queen. Tenants could not sell their holdings without his *congé*—i.e., permission. In 1572 Elizabeth made Sark a Fief Haubert (i.e., owing fealty only to the Crown) and sent six bronze cannon from the Tower of London.

One of them is still there. So are the 40 *tenements*, some of them still owned by the original families. Each *tenement* owner still gets one vote in Chief Pleas. You still cannot buy a *tenement* on Sark without the Seigneur's *congé*. The Seigneur still pays the Crown part of a knight's yearly fee (now inflated to £1.78).

Change comes slowly for Sark because, even in the late 20th century when Small is beautiful but keeps losing out to Big, Sark's variation of feudalism—a system set up to protect land—has proved effective. One of the differences between being, say, Seigneur of Sark and a peer of the realm in England, is that in England land and the job go with the title, while in Sark, the title and job go with the land. Since 1565, three families (de Carteret, Le Pelley and Collings) have had long Seigneurial runs, more than a century apiece.

The de Carterets lasted into the 18th century. Aside from settling the island initially and establishing the office of Seneschal (in 1675), the great de Carteret contribution was to see that if such small holdings of farmland kept being subdivided, the resulting parcels would soon be unable to support the owners, let alone a Seigneur. In 1611 Philippe de Carteret got new Letters Patent from King James I, establishing primogeniture. Land would go to the oldest son, or oldest daughter if no son survived. Modern Sark by and large still agrees with de Carteret. The fear of eroding the island's unique land-protection system is strong. That is the main reason why, when the Married Women's Property Law was finally passed, it did not include the right to dispose of "immovable property" on the island (i.e., Sark real estate).

*Undone by a vein of silver*

Well into the 19th century, Sark belonged to the Le Pelleys, who finally had to sell out because of the island's first brush with the Industrial Revolution. From Helier de Carteret's time the Seigneur has been entitled not only to *gravage* (value from anything washed ashore) but to anything mined on the island. In 1836, a vein of silver was found on Little Sark. More than 200 Cornish miners were brought in. Some of the shafts went down 600 feet and some ran 300 feet out under the ocean. During storms miners could hear great rocks rolling around on the floor of the sea above them. The silver soon ran thin. Ernest Le Pelley mortgaged his land holdings, but not even the promising shaft dubbed "Sark's Hope" could save him.

By 1853, for only £1,400 in cash, £4,000 in paid-up Le Pelley mortgages plus Queen Victoria's approval, Sark had a new Seigneurial family in the person of the Rev. William Thomas Collings. It was also about to be assaulted as never before by the equivocal forces of progress. From self-sufficiency based on farming, fishing and knitting, the island began to slide, slowly at first, into dependence on the tourist trade and an import economy. Increasingly the land was occupied by summer folk who did not work it.

The Rev. Mr. Collings loved Sark. He improved schooling, got on with the Vicar (a rare thing for a Seigneur), encouraged the building of small hotels and proudly refurbished the island militia—with brilliant red tunics (p. 98). On his death in 1882, he bequeathed the islanders, through son William Frederick and granddaughter Sibyl, a century of Seigneurial eccentricity and world-class dynastic soap opera.

William Frederick was over six feet tall, built like a guardsman, with hot blue eyes, a savage sense of humor

Seneschal Lawrence de Carteret (left) changes tire with help of islander in red tunic of defunct Sark Militia.

Boat builder Jeremy La Trobe-Bateman, not a native, was chosen to serve as island Connétable this year.

Clerk of the court, or Greffier, John Hamon is a blacksmith like grandfather and son Trevor (rear).

and a splendid mustache. Islanders held him in awe for he was a great sailor and cliff climber and a crack shot. But he was "a violent terror" when drinking. He regularly had to be called to account before the embarrassed Seneschal for such things as "brutally" terrorizing the Vicar's wife with his stick, chalking anticlerical slogans on walls, insulting the constable and "throwing his hat on the ground and calling him coward, damn fool and brute," breaking window panes, riding his horse into private gardens and threatening to shoot a journalist—who may, of course, have deserved it. He once turned up at dawn in Guernsey, drunk and clad only in a woman's petticoat.

He taught his daughter Sibyl to shoot and sail and climb cliffs like a boy. But when she dared to argue with him he threw a book at her and called her "a damned Virago." Sibyl had one leg a trifle shorter than the other, but William Frederick would brook no complaints of pain or unhappiness, telling his children that "they would be a lot worse off" before they were dead. "Only the smug and self-centered," he said, "could imagine that other people are interested in their troubles." Later in life Sibyl was grateful to him "for being able to live a life free of the inconvenience of self-pity."

*Barefoot and in her nightgown*

At 16, Sibyl fell in love with Dudley Beaumont, a young English painter who did her portrait. Her father was enraged; young Beaumont was a "weakling," he said, who did not shoot or climb cliffs. When Sibyl disobeyed him, seeing Beaumont again, William Frederick came to her bedroom at midnight, dragged her downstairs and put her out of the Seigneurie barefoot and in her nightgown. She crouched in a hedge till predawn, was hidden by the captain of the morning boat for Guernsey (her father stormed aboard in search of her as it was about to sail) and made it safely to a relative's house in London. There, in 1901, she married Beaumont and proceeded to have seven children. Her father did not contact her until the birth of her first (a girl). Then he composed what he thought was a conciliatory telegram: "Sorry it was a vixen."

None of this seemed to cramp Sibyl's already seigneurial style. She found children boring, she said, but was brilliant at amateur theatricals. When she lost her husband—and with him most of her income—at the end of World War I, she learned German (as a Sark heiress she already knew proper French and the patois as well) and got a job working with the British Army of the Rhine. Later she raised prize cattle.

By 1927, when she became Dame, postwar democratic reform had given nonlandowners a voice in the government (the 12 elected representatives) and grant-

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ed all males of 20 (and females of 30) the right to vote. But Dame Sibyl was hard to contain. For nearly 50 years she relentlessly made headlines all over the world (DAME OF SARK BANS AUTOMOBILES), publicizing the island and dramatizing herself in a role that seemed to combine Lady Bountiful with the Queen of Sark. "The people refer almost every possible problem or perplexity to me for a solution," she told an American reporter in 1929. "I love it." Sarkees ground their teeth when they read about it back home, but it helped her sell an autobiography (*Dame of Sark*) and drew the tourists. On the island she was a stickler for her feudal rights. She wrangled and harangued and pennypinched and indefatigably exhorted her fellow islanders, sometimes for sensible reasons, sometimes for shortsighted ones. But she saw that the island's feudal past was a crucial weapon in coping with survival in the crush of the modern world.

Toward the end of his life her father had been lax. But now islanders who had stopped paying their tithes of wheat or their *poulage* learned they would have to do so again. She was not backward about noting that when it came to the chickens, "they always give me the skinniest and oldest." Opponents raged about "feudal bondage in an age of advancing democracy," but she retorted that island agriculture needed to be encouraged so Sark would be more self-sufficient.

She was biting about any behavior that might trouble Sark's peacefulness, ruining it for the islanders and discouraging decent tourists: "Holiday camps and eyesores would destroy Sark's beauty," she wrote, "and all the nice tourists would stay away." Twice she pushed for an ordinance to blacklist in pubs anyone known to get ugly drunk, but it failed in Chief Pleas. She was witty and outrageous. She was fiercely against smelly, "hooting" powered vehicles. But she was also fascinated by filmmaking. During negotiations about shooting *Appointment with Venus* on the island in 1951, the Seneschal learned that Dame Sibyl had agreed to let a Land Rover ashore. The Pleas challenged the decision. "Oh," said the Dame, "I thought a Land Rover was some sort of senior Boy Scout."

With so many children, some usually in financial scrapes, she was ferociously eager to turn a penny. For a time Sark's constable was Henry Head, one of her greatest critics and the leader of the island faction that wanted to scrap Sark's feudal traditions. Knowing the Dame was familiar with *gravage*, he called her and mentioned that something important had washed ashore on the island. "It's mine," she snapped. Of course, he answered, and then told her it was a 25-foot dead whale—which she had to pay to get rid of. But it was characteristic of her that she refused her *congé* to a huge offer for the nearby small island of Brechou because the bidder was a real estate developer.

Dame Sibyl now appears on a series of Channel Island stamps, in one as a young girl whose portrait was painted by her future husband; in another, seated sternly beside her American second husband, Yaleman (1913) and World War I flyer Robert Hathaway, as the two of them confront two German officers just landed on Sark. World War II was a turning point in Sark's history and the Dame's finest hour. Almost all the "outsiders" (i.e., English) were evacuated. But Dame Sibyl

After traditional Sark weddings, bride and groom take cake and wine to the islanders unable to attend.

Upon reaching island, day trippers head out on bikes or carriages. Tractors are rare, but not rare enough.

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Map shows why Victor Hugo called islands "Bits of France fallen into the sea and picked up by England."

swore she would never leave and encouraged Sark-born people to stay too. And they did, sharing and rationing their food and working at Spartan self-sufficiency, and so preserved their island through four years of occupation. (Alderney, by contrast, chose evacuation; it has never recovered its prewar character.)

Even so there were vast changes after the war. In 1951, for instance, the Seigneur's veto power was cut to a mere 21-day delay. Today, the island's future seems to depend on whether it can keep financially independent without commercializing its way of life. Some 70,000 tourists a year visit Sark, most of them just for the day, but even so, island facilities are strained. There is less farming. Everyone fishes, but there are now only 20 commercial fishermen, including four lobstermen. More and more "outsiders" own the original *tenements*, which control a vote in Pleas. The French patois has almost died out—only one child of the 37 now in the island schools has both parents born on Sark. In 1968, in a closely fought battle, the Pleas rejected a long-range plan to control building and land use. But some measures have been taken. You can't build on agricultural land and you can't build at all unless you've lived on the island for ten years. "Otherwise," explains Michael Beaumont, who took over as Seigneur when his grandmother died in 1974, "Sark would be a sea of bungalows."

*The Seigneur can still deport you*

Beaumont is a soft-spoken aeronautical engineer and rocket designer. He let go all the Dame's servants when he became Seigneur, redid the wiring of La Seigneurie himself and charges 25 pence for a tour of its famous gardens. In marked contrast, too, he tends to downplay the importance of being Seigneur. On the books, he can still deport an undesirable from the island and is the only householder on Sark who can keep doves or a female dog—though visitors can now bring bitches ashore for up to 28 days. He serves on Chief Pleas and appoints the Seneschal, the Greffier, the Prévôt and the Vicar. The Seigneur's great power for good lies in withholding his *congé* from potentially unreliable buyers. "We're worried," an islander said to me, "that Michael may not be strong enough."

Others worry that the island, which has and seems to want no part of the British welfare state, will simply go broke. It is like a family or a small business, barely able to keep its head above water. As American parents worry about future college tuition, some islanders are haunted by how they will find the huge chunk of money that may be needed for an all-weather harbor or an island sewage system. Currently, except for hotels, drainage is left to the individual, an arrangement the Seigneur, as an engineer, regards as "pretty poor." But the banks, he wryly observes, "will never lend you anything until you can prove you don't need it."

Funds for those too sick or old to work are raised through a small visible-assets tax, and a capital tax which is assessed on a by-guess-and-by-God basis. "People pay because it's for the poor," says Seneschal Lawrence de Carteret, a collateral descendant of Helier. "Besides, the total asked for is laughable." Otherwise the island is run on £120,000 a year, most of it from the 45-pence landing tax paid by tourists.

Telling me this, the island's Greffier, John Philip Hamon, who is the Clerk of the Court in charge of records that run back unbroken to 1675, shudders at what would happen if bad weather or drain problems or connections with erratic off-island sea transport should cut back the tourist trade, even for a couple of years. At the same time the island can't handle any more tourists than it now has without messing things up. Hamon

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This picture was taken by setting the N2000 in the programmed mode, focusing and pushing the shutter button. Simple.

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Native islander Elizabeth Perrée studied in England but returned to run a hotel and *tenement* she owns.

Philip Le Feuvre, grower of fine beans and Sark's only butcher, descends from original island family.

admits he and other "chaps" discuss this dilemma in hopes "somebody can think of something."

The virtual ban on building, intended to prevent clutter and keep the island green, plus the press of rich English who buy on Sark to avoid British income taxes, has created a housing shortage plus inflated real estate values. Sarkees, especially the younger generation, have trouble finding a place to live and just at a time, with the average age more than 50, when islanders are facing the fact that Sark will not long flourish unless the young continue to make a life there.

Helen Gibson, a devoted teacher from the North of England, who has run Sark's schools since 1975, says "I've only lost five," meaning that only five of her students haven't settled in Sark sooner or later. She is tough on them, lecturing them on the need to avoid "doing a Sark," which means not turning up for work or an appointment, and encouraging them to see something of the world. There was a time when that would have been a tactical mistake, when the question, even on rustic and isolated Sark was, figuratively speaking, "How yuh gonna keep 'em down on the farm after they've seen Paree?" Now, says the Seneschal, Sark residents "can see the upheaval in the outside world" and a lot of what they see makes Sark look good. It certainly doesn't encourage the notion that the island should become more like other places.

*Nearly everybody has several jobs*

To make it on Sark nearly everybody has to have several jobs; families sometimes have whole clutches of them. De Carteret now runs the island's diesel-driven electric plant, but he repairs tractors and once farmed. When he's not in the Greffe office, John Hamon, like his grandfather before him, is the island blacksmith. (Any one of the 60 to 70 horses on the island can be shod for about £16.) His wife and son Trevor run the pub at the Bel Air Hotel, though Trevor eventually will take over the blacksmithing and is Assistant Greffier as well. Even for those who cannot step into a father's trade, there is a variety of work. Islanders are not rich, but with no taxes and almost no bureaucracy to support, the pence can add up. Life isn't boring if you mix things up, summer and winter—fishing, carpentering, painting, carriage driving, road building, tending bar.

If there's a wedding among Sarkees, the bride and the groom still carry cake and wine to all islanders who were too sick or too old to come. And if there's a big party, I was told, "everybody on the island is invited," though my informant quickly added, "the English won't come." Yet the sense of the English as standoffish "outsiders" has declined somewhat partly from intermarriage. "You can't put on airs here," says Michael Beaumont. And because everyone does so many differ-

ent jobs, he points out, "you're not judged by your employment at all," as you would be in England.

It is a closed world, especially in winter. Bitter feuds can break out over anything from a fancied slight to real adultery. "One difference between Sark and a small English village," says the Vicar, the Rev. Robert Harris, "in a village you can always hop a bus and get right away." Still, the island exerts its close-knit magic. "People may be savagely competitive about jobs and possessions," explains hotel owner Philip Perrée, "but they know if their carriage gets smashed or a horse bolts, they can count on a neighbor's help." To say nothing of care for ailing, noisy tractors, though many islanders feel that permitting them originally was the worst decision since Troy took in that wooden horse.

If Sark has a chance of making it to the end of the century still without a casino or a resort hotel, still free of motorcars and taxes, still green and underpopulated and still in possession of its past, it will be partly because island interdependence is not just a brotherly concept but a literal fact. On larger resort islands with similar problems in America, it is usually the rich summer folk who, having bought in, want to keep everybody else away, and the natives, driven by greed or sheer necessity, who sell out to builders with visions of Boatels and casinos dancing in their heads. But Sark is tiny. Almost *any* concession to raw commerce or the internal combustion engine would shatter its precarious, peaceful balance overnight, destroying what the islanders love, what the summer people sought, and what now draws the special breed of hardy tourists whose landing tax and spending keep the island afloat.

Unlike other islands, too, the relics of feudalism have given Sarkees political and legal machinery to help protect them while they find a way to keep the island going. One of the young people drawn to the island is Jeremy La Trobe-Bateman, 30. His father was a Shell executive who lived all over the world. Jeremy went to Harrow and hated it, finally settling on Sark for good. He builds boats, drives a tractor, paints, carpenters and this year is serving as Connétable. "There are 500 people here," he says. "Everybody knows everybody. It's the perfect place to sort out a system of government. If we can't get it together, nobody can."

Visiting sailors moor for the day in shallow bay between Sark and the cliffs of Little Sark beyond. Summer boats come from both France and England despite the local tides, which are huge and treacherous.

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Eternally inseparable, Wilhelm (left) and Jacob were nearing 70 when Elisabeth Jerichau portrayed them, 1855. Fascination with tales melding grotesque and gay-hearted resulted in a shared immortality.

*By Kathleen Burke*

# From the bookish brothers Grimm, a flood of fantasy

*But the fairy-tale collection that brought them fame was only the first of their best-selling bequests to Western culture*

"Bring me her heart," says Snow White's enemy in film. Grimms' Queen was haughty, Disney's had curves.

Once upon a time in the far-off principality of Hesse there lived two brothers: Jacob, who was slight and stern-faced, crotchety and reclusive; and Wilhelm, who was lanky and lively, high-spirited and witty. Their family name was Grimm. Born 200 years ago—Jacob in 1785 and Wilhelm in 1786—they collected the fairy tales that have mesmerized readers and listeners (and made "Grimm" a global household word) since the stories were first published in 1812. That was only the beginning. Theirs became one of the most celebrated intellectual collaborations in history: as pioneering folklorists, they gathered legends, folk tales, epics and Teutonic mythology that enlarged the definition of literature; they compiled the grandfather of modern dictionaries; and Jacob revolutionized the study of the growth of language.

During the fairy-story years, Jacob preferred to stay at his desk, scrawling away with a quill pen. Wilhelm was more likely to be spied under a linden tree hard by the village market in Kassel, where they lived, scribbling furiously as a seamstress or shepherd or woodcutter spun a tale. "In the days when wishes still helped," the storyteller might have begun—conjuring up images of golden-tressed Rapunzel, of Hansel and Gretel venturing hand in hand into the forest, Cinderella fleeing the ball as the clock strikes 12, Sleeping Beauty dreaming a century of dreams. The world being chronicled was one of intriguing ambiguities and sharp contours, where kindness brought its own reward and the vain and meanspirited invited retribution. The tales were to become, in all their shadowy allure, part of the universal fabric of childhood.

An idyllic existence—hens clucking in the courtyard, joy-filled Christmases, friendly neighbors—had nourished the brothers in their own childhood. Together they roamed the fields and forests of Hesse (a landscape of light and shadow and lurking phantoms even today), where a lifelong passion for collecting—plants, birds' eggs, butterflies, unusual stones—began.

But the happy days were shattered in the winter of 1796 when their father, a lawyer, died of pneumonia at the age of 44. Jacob was 11, Wilhelm 10. The family's straitened circumstances nearly ended the boys' formal education, though they managed to enter high school in 1798. Startlingly precocious, undaunted by six hours of instruction followed by four or five more of French and Latin daily, the brothers completed their studies in less than four years (half the usual time). When they entered the University of Marburg, they found a true introduction to the life of the mind.

Dutifully but unenthusiastically, Jacob and Wilhelm took up the law. Curiously enough, this brought them to the vistas of folklore. In Karl von Savigny, a young member of the faculty, they found a kindred spirit and mentor. His lectures on legal history drew on philosophy, literature, natural history and ethics: to him, the law reflected the culture from which it arose—as did folklore.

Savigny brought the brothers from the lecture hall into his drawing room and library, and to memorable

The Grimms collected tales of fantasy just as they were repeated, no embellishment—a brand-new way.

evenings of conversation and reading. Fortified by draughts of tea-with-red-wine, his guests talked late into the night; the air was heady with Romanticism as the young intellectuals, rejecting 18th-century rationalism and faith in the future, turned to the neglected masterpieces of Germany's past—epics and ballads, stories and poems that had sprung from the common people. Fascination with the folk origins of literature underlay the Grimms' entire career.

In Savigny's library, Jacob discovered a collection of poetry by Germany's minnesingers, the medieval troubadour-poets—his first encounter with the vigorous beauties of Middle High German. He was "intoxicated with joy and delight." Soon he was hoarding his meager allowance, haunting antiquarian bookstores and honing his skills as a linguist. (The brothers later commanded dozens of languages, Icelandic to Sanskrit, between them. In 1815, when Jacob served as a clerk at the Congress of Vienna, he fended off boredom by teaching himself Serbian. As diplomats bickered and redrew the boundaries of Europe, Jacob simply burrowed deeper into his grammars.)

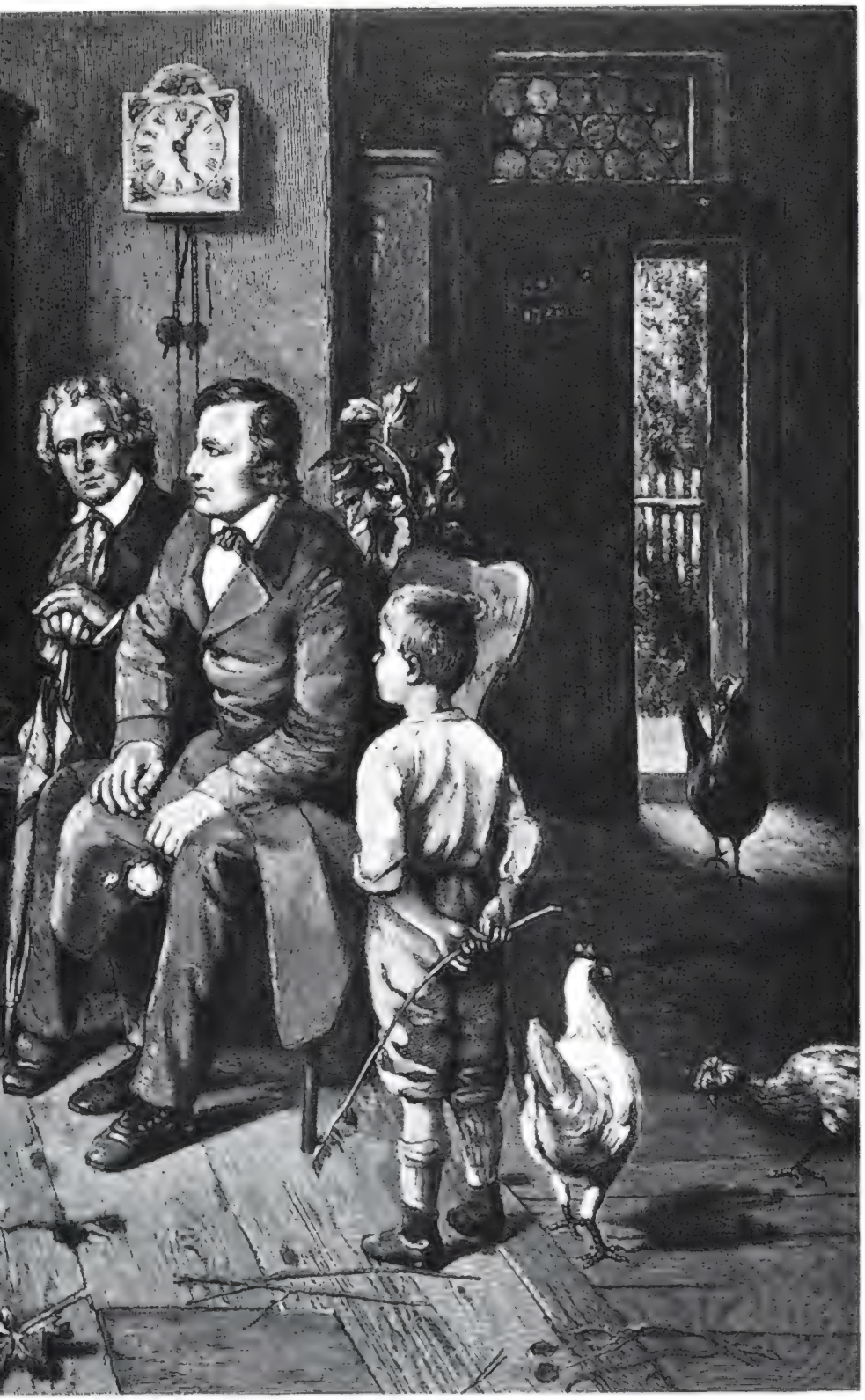
Feeling duty-bound to study law, the Grimms approached literature somewhat tentatively until early in 1805. Soon after Savigny traveled to Paris to research a history of medieval law, Jacob, his most brilliant student, joined him there. In that noblest of scholarly sanctuaries, the Bibliothèque Nationale, he found himself supremely content amidst a trove of manuscripts from the Middle Ages.

From Paris, letters flew between Jacob and Wilhelm. Jacob wrote of the city's splendors, describing the galleries with "beautiful Eycks and Bellinis" and poking fun at a night at the opera: "An old very fat and ugly actress played the youngest pretty daughter, because she had the biggest singing part, and she did sing truly beautifully. The eldest daughter was played by the youngest and most agreeable actress. All this contrives to make people not look but listen only."

Jacob's interlude in France had been nearly perfect —except that the brothers missed each other keenly. "What I would give," he teased Wilhelm, "just to see the curtain in your room, or hear you sing, badly as you have done it at times." They vowed never again to be separated. It was a promise kept: having completed their studies, they traveled home to Kassel. They shared a household for the rest of their lives.

By then, however, their mother needed her two older sons to support her and their brothers and sister. Wilhelm went so far as to pass the law exams, but never

*The author, an Assistant Editor, has covered dragons to computers for* Cobblestone *and* Faces *magazines.*



In artist's make-believe scene, brothers visit Frau Viehmann (center), who in life supplied many stories.

practiced. For him and Jacob, the lure of literature was overpowering, and Mother Grimm could not deny them their hearts' desire: scholars they would be.

So there they were, fledgling folklorists living in Kassel, well-bred and well-read graduates in search of gainful employment. Enter Napoleon Bonaparte, who probably never dreamed he would have a hand in so peaceable an enterprise as fairy-tale collecting. Yet he was a heaven-sent benefactor at the outset of the Grimms' career. In 1808, Bonaparte was at the height of his powers. His armies had swept across Europe and as he reapportioned his gains, he created new kingdoms, appointing relatives to administer them. Brother Jérôme became sovereign of the one christened Westphalia, with Kassel as its capital. For court librarian, Jérôme chose—and just in time—Jacob Grimm, recommended to him as speaking excellent French.

Jacob, a patriotic Hessian, had no love for the French occupiers, but his household was living in genteel poverty. His mother had died that spring, so at 23 he was head of the family—and Wilhelm was gravely ill. The librarian's salary was generous, the duties minimal and the opportunities to continue his literary research irresistible. Jacob dispatched Wilhelm to a spa, where hot baths, cold compresses and mysterious potions restored him to health and to story collecting.

Fairy tales had, of course, existed before the Grimms in various guises—used as vehicles for satire, embroidered by literary niceties—but never allowed their own simple beauties. Jacob and Wilhelm's intention, revolutionary in its day, was to record the tales just as they were told. (The Grimms are the forebears, if not patron saints, of any researcher who has set out for Appalachia or Polynesia, tape recorder in hand.) Until they began the collecting that absorbed them for more than six years, the enchantments of the untrammeled fairy tale had gone virtually unrecognized.

### *Wretched start for a glorious finish*

It was not an easy task, traipsing about in search of authentic stories. In their quest they enlisted friends, neighbors, old school chums—anyone they could—across Germany. Jacob kept to his study, collating the tales as they accumulated. Wilhelm trekked a few times into the countryside (where most storytellers were still to be found), but was met with rebuffs. Failing to coax a story from a recalcitrant shepherd, he dismissed the fellow in his journal as "touched by enlightenment." "The fairy tale collecting is going along wretchedly," he groused in a note to Jacob.

While many stories originated in rural Hesse, some came literally from the Grimms' doorstep. One old soldier bartered tales, including "The King of the Golden Mountain" (whose magic ring enables him to travel anywhere on the strength of a wish), for a pair of cast-off trousers. All six daughters of an apothecary next door were eager collectors. One, Dortchen Wild, was to become Wilhelm's wife; he recorded a number of tales at her side. And another friend, *die alte Marie*, proved to be an indispensable raconteur. A widow whose Hessian-mercenary husband had died in the American Revolution, Marie wove seamless, compelling stories by the dozen—nearly a quarter of those, including "Sleeping Beauty," "Little Red Riding Hood" and "Snow White," that appeared in the Grimms' original edition (they would publish more than 200).

Even a family of madcap aristocrats, the von Haxthausens, university friends, turned their formidable energies to story collecting. From a country estate, one or another of the daughters was always hitching up her

Over the years, illustrators choose their own points of focus. For princess-turned-goosegirl, George Cruikshank, 1826 (above), shows power to command wind; Arthur Rackham, 1909 (right), depicts despair; Heinrich Vogeler, 1907 (far right), tells full story.

skirt to clamber over stiles, rap on cottage doors and pester peasants out of wonderful tales, among them "The Bremen Town-Musicians," that paean to animal rights. In it a cat, cock, dog and donkey—all ancient and soon to be destroyed by heartless masters—journey together to seek their fortunes. Outside a robbers' den they stage a fearsome quartet of braying, barking, meowing and crowing. The thieves flee; one hapless robber stumbles back into the darkened house only to be set upon by the cat, bitten by the dog and kicked by the donkey, as the cock shrieks from the rafters. His report of the encounter terrifies the others: "There is a horrible witch sitting in the house, who spat on me and scratched me with her claws; by the door stands a man who stabbed me in the leg; in the yard lies a black monster who beat me with a club and on the roof sits the judge who called out, 'Bring the rogue to me,' so I got away as well as I could." After that, "the robbers never dared enter the house, but . . . the four musicians . . . did not care to leave it anymore. And the mouth of him who last told this story is still warm."

As the collection grew into unwieldy stacks, the temptation to continue gathering, along with a compulsion for scholarly perfection, could have prevented publication altogether. Fortunately another university friend, Achim von Arnim, arrived early in 1812 to galvanize Grimm and Grimm. Wilhelm later recalled the decisive afternoon in their study: "It was Arnim who drove us to publication. . . . Pacing up and down, he read sheet after sheet, while a tame canary was perched on his head, and appeared to be quite at home amidst his thick locks." Von Arnim immediately recognized the tales for their eloquence and authenticity. He swiftly secured a Berlin publisher.

The first edition appeared in time for Christmas 1812. The 900 copies sold steadily. Second only to the Bible, it was to become Germany's most widely read book, one that W. H. Auden would describe as "among the few indispensable, common-property books upon which Western culture can be founded."

With the Grimms' mission popularized, more collaborators joined their search for people who could tell authentic stories, people like Dorothea Viehmann (pp. 110-111), who walked to Kassel from a nearby village each week to peddle eggs. The child of an innkeeper, she had grown up spellbound by travelers' tales and called up a host of characters: the goosegirl, a princess in disguise robbed of her birthright (above); the clever peasant who "had not even a cow," yet hoodwinks an entire village and becomes rich; a soldier who serves as the "devil's sooty brother," gleefully stoking the fires as his commanding officers boil in the kettles of hell. The Grimms brought out their second edition in 1819—this time with handsome engravings (p.114) by brother Ludwig Emil. They never again labored in scholarly obscurity. When Wilhelm traveled to Frankfurt to visit Goethe in 1815, he reported that "the fairy tales have made us famous everywhere."

Quick as you can say Rumpelstiltskin, the tales inspired rendition upon rendition by composers and artists from the Grimms' day to our own. Nineteenth-century opera audiences took to their hearts the clever heroine of *Hansel and Gretel*, who bakes the witch

into a toothsome honey cake. (The Grimms' version of her demise doesn't offer the gourmet twist: Gretel simply shoves the witch into the oven, "where she was miserably burnt to death.") The plot of Rossini's *La Cenerentola* turns not on Cinderella's slipper but a bracelet; even so, the ugly stepsisters are as incensed as ever when she wins her prince. Artists from George Cruikshank (p.112) to Maurice Sendak (SMITHSONIAN, January 1982), who captures the stories' droll, dark undercurrents (p.118), have done superb interpretations.

An enormous 20th-century audience first encountered the Grimms' work at the Saturday movie matinee. Walt Disney's *Snow White, Cinderella* and *Sleeping Beauty* cast their spell on an entire generation of children. Classics of animated film that they are, these versions blunt the fierce energies of the tales that inspired them. In the original "Cinderella," for example, the sisters are so consumed by greed that one lops off her toe, the other her heel, in attempts to squeeze into the golden slipper. "When you are Queen, you will have no need to go on foot," goads their mother. Vengeance is swift: telltale blood oozes from their shoes and "for their wickedness and falsehood," pigeons swoop down and peck out the sisters' eyes. "They were punished with blindness all their days."

The controversy about the tales' suitability for children began almost at once. Critics argued that some stories were far too ghoulish for young readers—those like "One Who Went Forth to Learn Fear," in which the hero shares a bed with a corpse, plays at ninepins with dead men's shin bones and skulls, yet still cannot discover what it is to shudder. Wilhelm advised that parents might spare sensitive children the more gruesome tales: "There may be some who dare not put their pot plants in the rain, for fear they might suffer as they are delicate. They prefer to water them indoors." Yet, he argued, the stories must be allowed to stand in their entirety: "Surely, they would not demand that rain and dew should cease altogether. Everything that is natural is wholesome."

The full-scale debate about the meaning and import of the tales did not, however, gather force until early in the 20th century. Scholars, finding the stories richly layered as any Sacher torte, began producing a steady outpouring of interpretations. Freudians and feminists, Marxists and Jungians have offered readings by the score. Is Snow White the prototype for the proper —and submissive—19th-century hausfrau, what with all that dutiful sweeping and plumping of pillows for the dwarfs? Are the Grimms' heroines voiceless shadows, their lives suspended as they await the problem-solving princes? (Yet quick-witted maidens, Gretel

Engraving (later tinted) of Hansel and Gretel, 1819, is one of many by another brother, Ludwig Grimm.

Non-Disneyesque dwarf keeps vigil over Snow White's elegant casket in Albert Hendschel's 1867 lithograph.

among them, abound in the stories.) And might not the dwarfs represent warring aspects of the "unintegrated personality"? Is Little Red Riding Hood acting out the conflict between ego and pleasure-seeking id as she strays from the forest path? Can Sleeping Beauty's dreamlike trance symbolize an inability to resolve adolescent conflict and move on to adulthood? Is "Hansel and Gretel" a story set in motion by exploitation, the father-woodcutter unable to support his family in an oppressive feudal economy?

*Power to terrify and console*

Whatever meanings may emerge, the world of the fairy story can seem nightmarish indeed, where a child is born "a hedgehog above and a boy below," cannibalistic witches entice children into quaint cottages, a little girl meets the lascivious wolf in the forest. What of these powerful and fearsome images? Why do these tales speak so deeply, not only to children but to our own deepest longings and dreams?

Perhaps child-psychologist Bruno Bettelheim gets to the heart of the matter when he argues, in *The Uses of Enchantment*, that the fairy tale's power lies in its capacity at once to terrify and console. Speaking in imagery at times stark and brutal, the stories address complex and disturbing themes: sibling rivalry, sexual awakening, parental betrayal, Oedipal conflict. They are tales about overcoming adversity. Cinderella dazzles at the ball and wins the prince, Gretel casts the witch into the oven and frees her brother, the hedgehog-child is transformed into a young man of noble bearing. It is this message, that the truehearted can trust in themselves and find a path through the forest, that children take from the tales. "As long as children believe in witches," Bettelheim contends, "they need to be told stories in which children, by being ingenious, rid themselves of these persecuting figures of their imagination." The accomplishments of fairy-tale heroes and heroines are crucial to us all: identity is forged, relationships resolved, intimacy achieved, the larger world embraced.

While the fairy stories were appearing, Jacob and Wilhelm published other works at a dizzying rate. (At the library they were back in Hessian service, their sovereign having reestablished himself after Napoleon's defeat and Jérôme's hasty exit in 1813.) The first of two volumes of German legends appeared in 1816. The stories were rooted in actual times and places, rather than the make-believe world of fairy tales, and catalogued another kind of character—Wilhelm Tell, the Pied Piper of Hamelin, Lohengrin.

Wilhelm took on more and more of the fairy-tale work, editing 17 editions in all. Over the years, he began to impose something of his own style on the col-

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Vignette of Cinderella's trials appeared c. 1880 in chromolithograph from Walter Zweigle's watercolor.

Sleeping Beauty takes a whiff of smelling salts in Dutch illustrator Marie Cramer's 1920s version.

lection. According to Grimm authority Ruth Bottigheimer, he may have invested later renditions "with the values underlying his own 19th-century German bourgeois society." But Wilhelm always felt that he had remained true to the spirit of the narratives.

Jacob next turned to his *German Grammar*, which established him as one of the century's preeminent scholars. His reticence (an afternoon spent with visitors elicited "Whole day wasted" in his journal) gave way to reclusiveness as he demonstrated the relationships among the Indo-European languages. Of Jacob's book, Murray Peppard writes: "The thrill [for the literate world] that came with the certainty that Latin, Greek, German, Slavic, Celtic, and Sanskrit were all members of the same linguistic and cultural family" was great. Slavic and German could no longer be dismissed as the vulgar offshoots of tribal dialects. One result of the *Grammar* (likely the world's first to be an instant best-seller) was that German began displacing Latin and Greek in the nation's universities.

Jacob was delighted by the accolades given the *Grammar* in 1819 and its second edition in 1822, of which he wrote to friends: "I will take good care not to send it to you because you would be sure to say, why all this fuss about letters and words! But I will defend myself and answer: the Lord made small things as well as big ones, and everything man looks at closely is full of wonder: language, word and sound."

Growing renown brought modest prosperity—and marriage. An illustrated nursery version of the fairy tales sold briskly in Germany. In 1825 Wilhelm married Dortchen Wild. Within three years Jacob was a doting uncle: he became beloved *Apapa* (Grandpapa) to each of Wilhelm's three children. Dortchen understood Jacob's ways: she fussed over him, cut his hair, mended his clothes—and he adored her.

*"They have never done anything for me!"*

As the family grew, Jacob and Wilhelm needed more money. They hoped to be advanced to head and assistant librarian, but in 1829 the Hessian sovereign named the court archivist to the post. Jacob was incensed, even-tempered Wilhelm distressed. With their pride at stake, the brothers accepted positions at the University of Göttingen. The sovereign harrumphed: "The Herren Grimm propose to leave. A great loss! They have never done anything for me!" Thus he turned Germany's most honored scholars out of his kingdom.

The Grimms' career in academia ended abruptly in 1837 when a new monarch—Ernest Augustus, Duke of Cumberland and uncle of Queen Victoria—succeeded to the throne of Hanover. An archreactionary who proclaimed he valued "eight hussars more than the entire university," he imposed a new constitution and or-

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dered all civil servants—including professors—to swear loyalty. Seven faculty members, Jacob and Wilhelm among them, signed a protest. The king immediately dismissed them. Within three days, Jacob had been marked as one of the ringleaders. Accompanied by the king's troops, he was escorted back across the border into Hesse. A raging controversy erupted: the matter of the Göttingen Seven was taken up by journalists across Europe. Nevertheless, once Jacob published his manifesto, "Concerning My Dismissal," he wanted nothing more than to retire to his study in Kassel.

The most pressing problem, as before, was money. Jacob, convinced that they must find an independent means of support, found a solution in a publisher's proposal. The brothers announced their new project in the press: "Jacob and Wilhelm Grimm . . . have found the courage to insure and fortify their own future. They are undertaking a great German dictionary . . . as a difficult, far-reaching work . . . to contain the infinite wealth of our fatherland's language from Luther to Goethe . . . the result will be astonishing."

Nothing like it had appeared before; it remains the greatest dictionary in the German language and served as precursor not only for the *Oxford English Dictionary* but for similar modern works. Even Jacob did not realize the monumentality of the task he had begun. For the rest of their lives, the brothers wrestled with the complexities of the dictionary. (Subsequent scholars took up their project, finishing only in 1960.)

Soon came the call to Berlin. In 1840, the King of Prussia recognized the brothers for what they were: national treasures. Friedrich Wilhelm IV offered them generous recompense for their labors in the service of German language and literature. He called the brothers to work "here in the capital, with leisure, freedom from care, and with the use of all aid and support"—a fairy-tale kind of gesture. The early weeks became a triumphal progress. Jacob and Wilhelm were greeted by the king, feted by colleagues and welcomed by old friends, including Savigny, now Minister of Justice. University students rose to cheer as the brothers, gray haired, standing a bit stooped, arrived to lecture.

Wistful references to Kassel began to disappear from the Grimms' correspondence. They became Berliners. Social engagements barred them from their studies more than they liked. During an illness, Jacob wrote that the doctor had ordered him to remain at home "and, as you can imagine, that suits me quite well." Secretly, he must have been pleased at the acclaim, honored by the visitors who sought an audience.

Fraternal devotion lasted a lifetime—and beyond. After Wilhelm's death in 1859, Jacob, for the remaining four years of his life, insisted that his brother's study remain untouched: chair at the desk, heliotrope and primroses tended, favorite prints on the wall, books open. Jacob's eulogy before the Berlin Academy of Sciences was testimony to his loss: "At night in my dreams, my brother is still beside me. Of all our books, the fairy tales were closest to Wilhelm's heart. . . . Every time I take up these tales, I am deeply moved, for on every page I see him before me, and recognize his mind at work. . . ."

What might they have thought, Jacob and Wilhelm, come face-to-face with Sigmund Freud's reading of "Little Red Riding Hood"? Or poet Anne Sexton's versions of their tales, set to music in the avant-garde opera *Transformations*? (Rumpelstiltskin is a caricature of Truman Capote; other characters seem to embody every 20th-century psychosis.) Chances are they would have brushed all that aside, leaned back in their chairs and envisioned spellbound listeners drawn up before a hearth as the winds howled and night fell hard and fast. And they would have known it was for this—the homely beauties, the grace, the ageless power of the tales—that they harvested sheaves of stories faithfully and well.

Showing Wild (Wilhelm's in-laws) apothecary at lower right, Ludwig drew Kassel from brothers' house, 1842.

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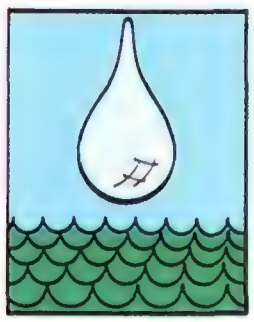

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The right choice.

*By Vincent G. Dethier*

# The magic of metamorphosis: nature's own sleight of hand

*Many animals radically change their form and function as they go through life; their genes are carrying two sets of messages*

A small child watched in wide-eyed wonder as a monarch butterfly struggled from its chrysalid skin. The emergence of the butterfly was as magical to the child as the appearance of a rabbit from the hat of a magician. For those of us who are older the magic has vanished, but the wonderment remains. We who are born in the image of our parents, who grow, develop and mature with measured grace and predictability, tend to assume that all creatures grow with a comparable gradual, ordered cadence. We expect no abrupt changes in form. We ourselves look human from the moment the egg completes the early developmental stages that are common to all animal eggs. At birth we are very well-developed little people, and from that time on we pass through infancy, childhood, puberty, adolescence, maturity and old age with few visible changes other than those wrought by hormones, accident and the ravages of time.

Yet we are fascinated by the idea of metamorphosis. It permeates our mythologies, theologies, fiction and art. We find it in Ovid's *Metamorphoses*, Stevenson's *Dr. Jekyll and Mr. Hyde* and Kafka's *Metamorphosis*. We need not, however, turn to imagination and dreams. In nature, metamorphosis is real. The world around us teems with animals that undergo such drastic changes in form that skilled scientists have on occasion described the young as one species and the adults as another.

Change is universal, but metamorphosis is a special kind of change. Literally speaking, it is a change in form, usually but not necessarily abrupt. It is accompanied by an alteration of style of life, biochemistry and behavior. Often the metamorphosed animal occupies a different habitat from that of its larval days. These changes are strikingly represented by moths and butterflies, aerial creatures borne aloft on colorful gossamer wings, feeding delicately on nectar and epitomizing the ideal carefree existence. Without foreknowledge no one would ever guess that a caterpillar would come to this.

Butterflies and day-flying moths are designed to survive the dangers of sunny days during which they are prey to insectivorous birds, crab spiders lying in ambush among the petals of flowers, mantids camouflaged in the foliage and hosts of other rapacious predators. Night-flying moths are fair game for sonar-tracking bats and other nocturnal hunters. Over the millions of years that the species have been in existence, they have evolved clever ruses to avoid violent death, and intricate rituals of courtship to perpetuate their kind—but their kind also includes caterpillars.

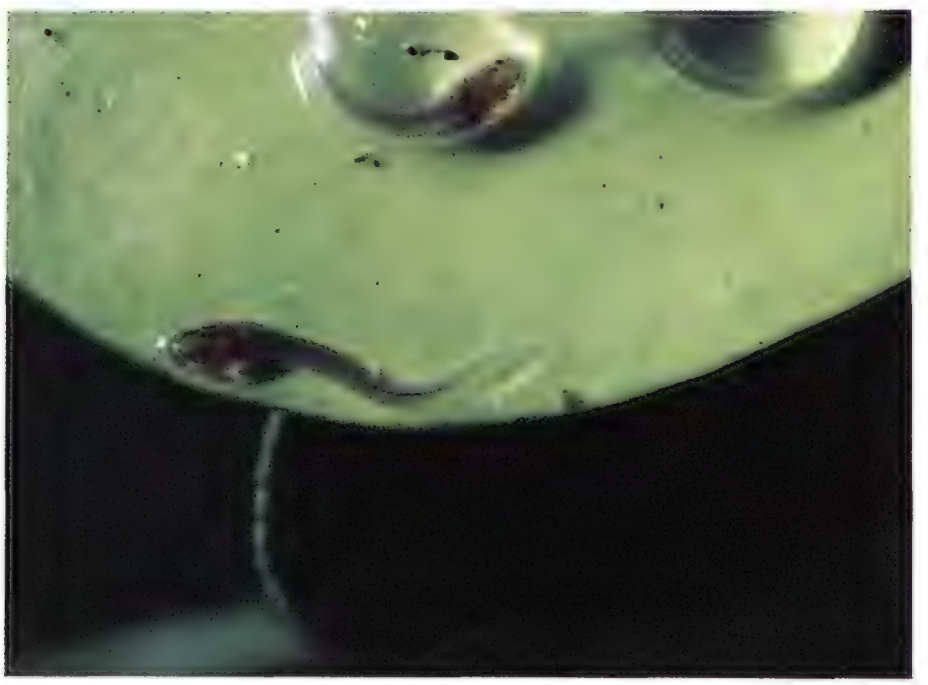
At a propitious moment females seek places to lay their eggs. Some species are remarkably cavalier, laying their eggs with abandon on stick, stone or lamppost. One of the keys to the gypsy moth's success is its propensity for laying eggs on camping vehicles which carry them to far places. Other females are more fastidious. It is at this point in their lives that the first intimation of a double life is revealed. The meticulous female, whose lifetime association with plants has centered on flowers and nectar, develops an interest in leaves. She seeks out plants that she may never before have visited and with which she has had no behavioral or metabolic association. On selected leaves and twigs she lays her eggs.

The first surprise for those who do not know is the

The Mexican bean beetle is seen here in all stages of metamorphosis. At the top and bottom are adults, the latter laying eggs. Larval stages have "spikes"; pupae are smooth with old skin crumpled at one end.

Eggs are visible inside a Fleischmann's glass frog, seen from underneath through a clear panel.

Male glass frog stands guard over egg mass attached to a leaf; tadpoles are visible in the clear jelly.



Tadpole, now hatched from the egg, is getting ready to drop off the leaf edge into the water below.

emergence from the egg of a small caterpillar instead of a miniature butterfly. After all, hens' eggs produce chicks, turtles' eggs produce small turtles, grasshoppers' eggs produce small grasshoppers. Only in stories like E. B. White's *Stuart Little*, in which the offspring of a surprised couple was a small mouse, does one expect to find organisms not replicating their kind at birth or hatching.

If butterflies could think, imagine their astonishment and dismay at viewing their firstborn. The actions of the caterpillar appear to defy the laws of genetics. The newly hatched one begins its life by consuming the eggshell; thereafter, it embarks on a gourmet vegetarian life. It has its own particular enemies: birds that did not attack its parents; hordes of predatory ants and carnivorous bugs; legions of parasitic flies and wasps; and infections by viruses, bacteria and fungi. Just as the butterflies evolved over time to become successful butterflies, so did the caterpillars evolve during the same period to become successful caterpillars.

The collection of genes that the butterfly bequeathed to the caterpillar must program the structure and behavior of the caterpillar and at the same time carry in trust the traits of the adult that the caterpillar will one day become. Just as the adult harbors within its body the germinal tissue that is to become the caterpillar, the caterpillar from the day of hatching carries within its body small pockets of cells destined to form a butterfly.

Obviously, however, the relationship of two directing forces within one body cannot continue harmoniously forever. Such a course would lead eventually to a chimera: half caterpillar, half butterfly. Chimeras populated mythology, but they could never survive the vicissitudes of a hostile world. At some point an intermission in growth must occur to reset the stage, and the intermission must not expose the animal to attack. The solution is a pupal stage.

*Acrobatics before the great transition*

In preparation for this momentous transition, different species of caterpillars perform acrobatics that are marvelous to behold. Swallowtail caterpillars perform right side up, monarch caterpillars upside down. The swallowtail caterpillar (pp.128-129) spins a small silk pad on a plant stem and fastens the hooks of its last pair of prolegs into it. Secure on this end, it reaches up the stem and builds itself a safety belt by fastening a strand of silk to the stem where its left shoulder would be if it had one. Spinning out the strand, it produces a long loop reaching over its head and fastens the end to a spot near its imaginary right shoulder. Repeated spinning back and forth produces a many-stranded belt. The caterpillar then must wriggle this

Tadpoles of the Western spadefoot toad struggle to reach adulthood in a quickly drying rain pond. Those with free front legs, like the dark one at the top center, are almost ready for life on land.

belt down over its back until at the completion of the maneuver it resembles a window washer leaning back against his safety belt. There is a practical way to appreciate the difficulty in accomplishing this feat. Take a four-foot length of twine with a bit of adhesive on each end. Stand facing a wall. With most of the twine in your mouth, attach one end to the wall at shoulder height. Next, by moving your head, pay out the twine from your mouth, bending your head as far back as possible and twisting to produce a long loop. Attach the second sticky end to the wall near your other shoulder. Now, wriggle yourself under the loop until it fits snugly around your shoulders.

If you conquer this challenge, try to emulate the monarch caterpillar that fastens its last pair of prolegs to a pad of silk on the underside of a milkweed stem, hangs head down, splits its caterpillar skin along the back, wriggles free and at the last moment attaches its pupal hooks into the silk pad without falling to the ground. You can best appreciate the problem by hanging from a tree branch with both hands gloved, removing your hands from both gloves *simultaneously* and grasping the branch with bare hands before falling.

The pupa (known as the chrysalis in butterflies) is a strange mummylike creature. The animal that was the caterpillar seems to have fallen asleep. It will wiggle restlessly if poked, but otherwise shows no sign of life. There are traces in bas-relief of the adult to be—indications of adult eyes, stubby wing pads and outlines of antennae and mouthparts.

The quiet exterior is no indicator of the turmoil that is going on internally. Most caterpillar tissues and organs are being broken down and recycled. Genes of adult tissue that had been quiescent are now released from suppression by a complex interplay of hormones. As caterpillar organs are dismantled by programmed cell death, their raw materials are built into adult organs. Within a few days, or for some two weeks (unless the pupa is overwintering), a complete adult has been constructed. At the appointed moment the pupal skin splits and a bedraggled but complete adult appears. The magic that the child has seen in the emergence of the butterfly seems even more magical when one understands the biochemical and physiological events that had to be coordinated to make the trick work.

Why did such complicated transformations evolve

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and what advantages do they confer? One could imagine, for example, that a more direct method would be a disadvantage in some cases because it would produce moths, butterflies, flower flies and bees so small that their tongues could not reach down into the corollas of flowers. This argument would not apply to leaf-feeding beetles, however, because little beetles chew leaves as well as big ones.

Some scientists have suggested that complete metamorphosis is a splendid way of life because it allows a species to exploit more of the environment. Because nectar-feeding adults do not compete with leaf-feeding caterpillars, denser populations of the species can exist in a given area. This argument is less compelling when one considers Mexican bean beetles, Colorado potato beetles and ladybird beetles, species in which young and adults dine on the same menu at the same table.

Probably we should look at metamorphosis with an evolutionary perspective. Its common occurrence in nature, the many forms that it takes and its appearance in numerous unrelated species suggest that it was designed very early in geologic time and reappeared independently many times. It may have been part of such steps as ventures into fresh water, emergence onto land, and the establishment of mutualistic relations—for example, pollination—with land plants.

Different crises and different opportunities would call forth different designs for metamorphosis. Not all insects go to the extremes shown by moths, butterflies, beetles and others. Eggs of crickets, for example, hatch insects that are undeniably miniature crickets. They lack wings, hence they are unable to chirp and serenade one another—and have little need to anyway because they are sexually immature. But they are crickets. Unlike caterpillars, which keep adding caterpillar tissue, most of which never becomes directly part of the adult, the cricket, like you and me, grows and develops adult tissue from the day it hatches. In manner of growth it differs from us principally in shedding its skin periodically. The final shedding to adult state marks its maturation and ends its metamorphosis.

Dragonflies, damselflies, kissing bugs, assassin bugs, stink bugs, squash bugs and scores of others have settled on a strategy intermediate between butterflies and crickets. The slender, graceful, metallic green or blue damselflies fly in tandem while mating. The females are clasped around the "neck" by claspers at the end of the male's abdomen. The male alights on a water plant, the female bends her abdomen into the water and lays her eggs on the submerged stem. The insect that hatches from that egg is a naiad, named for the mythological nymphs who frequented streams and waterfalls. The insect naiad is a slim aquatic creature with large eyes, three leaflike anal gills for respiration and propulsion, and a most remarkable mouth. This mouth is equipped with strong serrated mandibles and maxillae, but both are masked by a long lower lip that at rest is folded over them. The end of this lip is armed with sharp hooks. When small aquatic animals stray within reach, the naiad thrusts out the lip in a lightning stroke, seizes the hapless victim and transfers it to the mandibles.

*From aquatic naiad to airborne damselfly*

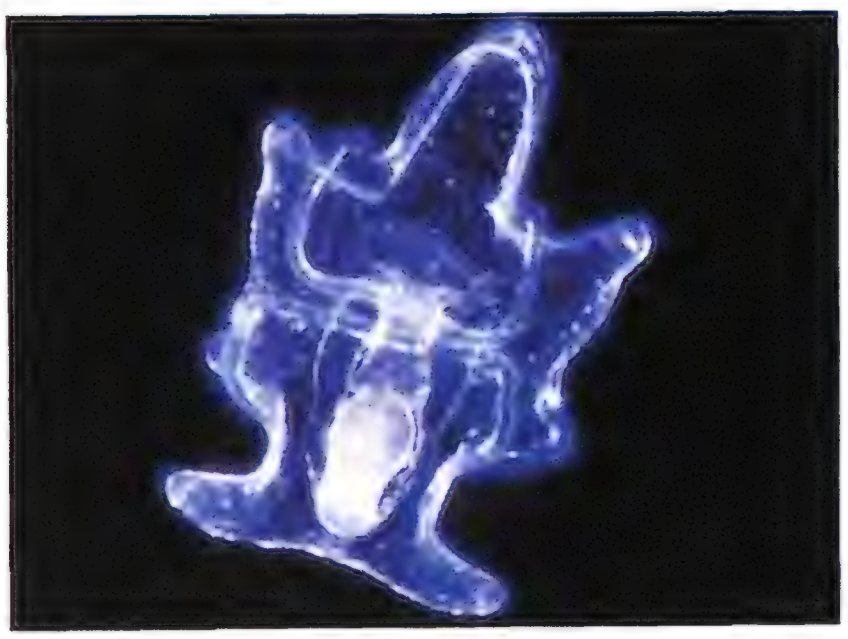
The naiad is a compromise between the complete metamorphosis of the caterpillar and the imperceptible metamorphosis of the cricket. It is a fierce, formidable underwater predator growing stronger with each molt, attacking larger prey while at the same time preparing to be a damselfly. It has large efficient compound eyes that will also be the eyes of the adult. It has stubby wing pads growing externally as wings should, but they are no hindrance to aquatic living.

Finally, when it reaches full naiad size, some inner urges impel it to crawl up the stump of a plant or up a stick or rock projecting above water. For a truly aquatic animal to desert water for air would have been unpardonable at any other time. It would have meant a slow desiccating death. But now the inner damselfly asserts itself (p.131). The naiad skin splits along the back, legs are withdrawn as though from stockings, the gills peel off, wings are unpacked from wing pads and almost like an inflatable life raft are pumped to full size by pulses of blood. When all is finally taut and dry, the new insect is ready to launch itself on its maiden aerial voyage.

Everywhere in the quiet pond from which it emerged, other exciting metamorphoses are taking place. Beneath the placid surface, voracious larvae are becoming diving beetles and whirligig beetles; wriggling mosquito larvae are forgoing a diet of micro-

Three "toes" of a sea squirt larva (left) will attach to a rock so that adult can lead stationary life. Yellow adult (above) coexists with soft red coral.

An adult sea cucumber (above) waves tentacles it normally uses to sweep food off the bottom. It bears no resemblance to its larval form (left).



A starfish larva (left) shows the same side-to-side symmetry that we do. Adult form of starfish (above) shows a totally different radial symmetry.

Caterpillar of a spicebush swallowtail butterfly hangs from twig on silken "safety belt" it has spun.

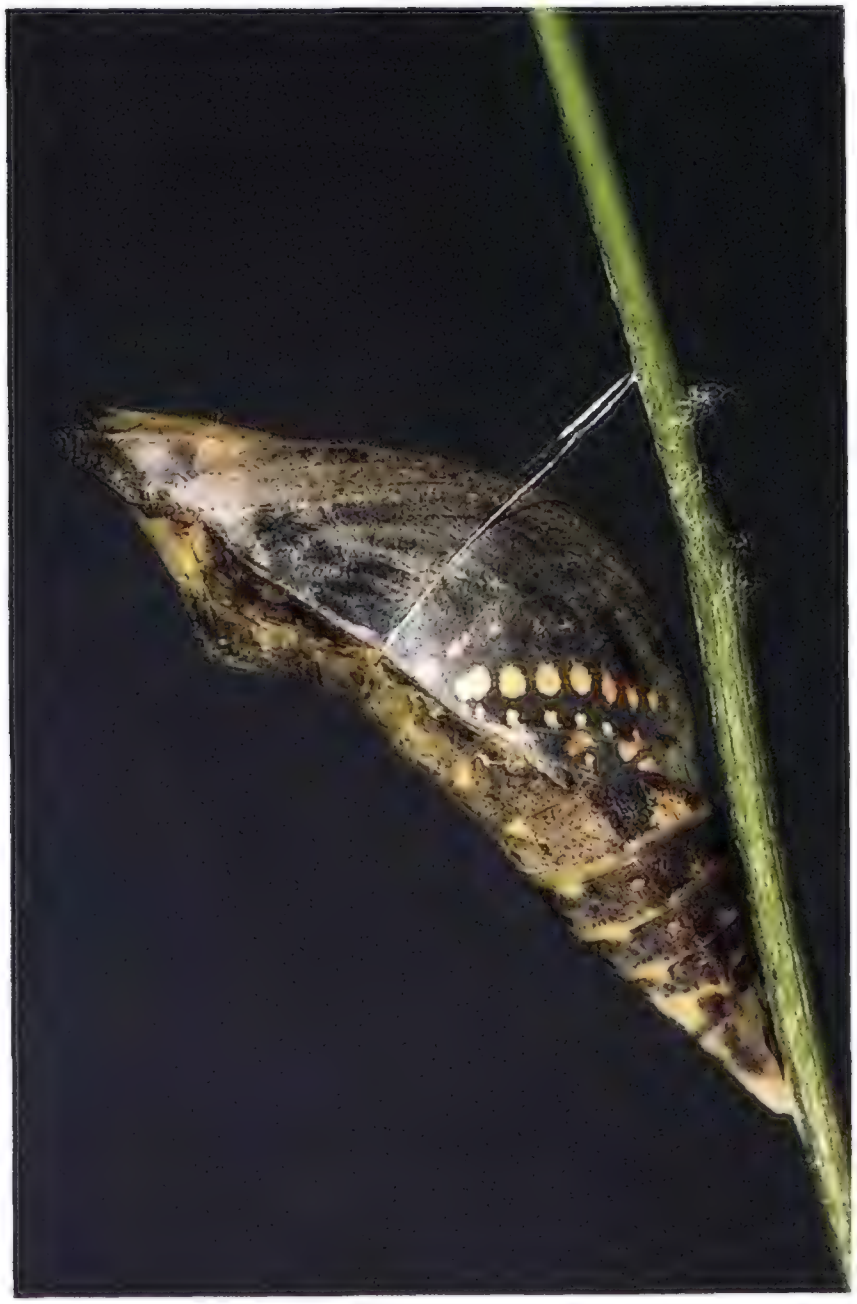
It manages to shed its caterpillar skin without losing or tearing belt, revealing the pupa inside.

organisms, becoming pupae and metamorphosing into bloodthirsty adults; young giant water bugs, water boatmen, backswimmers and water scorpions are becoming sexually mature, winged adults; grubs and maggots in bottom mud and decaying vegetation are turning into crane flies, midges and beetles.

Fresh water, however, is not the place to search for memories of ancient customs. One must turn to the ocean where life began because here there are still creatures whose lineage stretches further back in time than that of insects. The ocean provides a more continuous record of what has been. It harbors a bewildering collection of monstrous larvae saddled with a correspondingly bewildering array of complex names. Perhaps here one can find some clues to the meaning of metamorphosis.

One can conceive of an advantage to an organism in restricting the amount of yolk packaged in an egg. Some starfish seem to do this. The yolk supply is limited, the egg "hatches" an animal that is still an embryo with a lot of development still ahead of it. It is, however, well equipped to fend for itself. What hatches from a starfish egg is little more than a ball of cells covered with motile cilia providing propulsion. As a ball, it swims around continuing the development which in other animals occurs within the safe confines of an eggshell or in the nourishing protection of a uterus. It becomes a larva, the bipinnaria, a weird, lobed little monster with looped bands of cilia (p.127). Eventually, after a succession of odd changes, it attaches itself to some handy bit of substrate, where it metamorphoses into a recognizable starfish.

A different kind of metamorphosis characterizes a beautiful, iridescent, segmented creature with the mundane name of clam worm. Its scientific name, *Nereis*, is much more romantic. *Nereis* was named after the Nereids of Greek mythology who were graceful sea nymphs. The adult worm can lay legitimate claim to this name because it is the most elegant of creatures when it deserts its burrow to undulate



Within the pupa, the magic of metamorphosis is taking place; wing patterns are clearly visible.

Metamorphosis complete, a new swallowtail dries its wings before embarking on a whole new life.

smoothly through the clear green seawater. Upon hatching from the egg, however, it is a dull larva with the technical name of trochophore. Trochophore larvae resemble two opposed bowls, one capping the other. A belt of cilia wraps around the middle and a ridiculous-looking tuft of cilia extends from the top. Gradually this larva transforms into a worm by elongating and adding segments to its lower part.

The most complicated life histories known are those of parasitic worms. Blood flukes, which cause the disease schistosomiasis, and liver flukes undergo an extravagant series of changes. Consider the life history of the Chinese liver fluke. This flatworm is a hermaphrodite that lives in the liver of human beings. Here it produces fertilized eggs that pass into the host's intestine and from there into canals and irrigation ditches. The released eggs are eaten by snails, where they hatch in the intestine. Each emerging larva, the miracidium, finds its way into the snail's tissues, where it loses its cilia and becomes a sac called a sporocyst. Eventually the sporocysts produce new forms (rediae) that in turn develop into tadpolelike forms called cercariae. These, liberated from the snail, swim freely in the water until they encounter a freshwater fish. They bore into the muscle and are encapsulated. When a human being eats the fish raw or half-cooked, the cysts are digested in the stomach. Young flatworms emerge and journey up the bile duct to the liver, where they may live happily for many years to the distress of their host.

All these last cases of metamorphosis have evolved independently at different times, presumably in response to change or as adaptations enhancing survival and competition. All share one feature, larvae that can disperse widely in ocean currents (or fresh water in the case of parasites). The survival and propagation of the species benefits by separating two basic functions. Dispersal is relegated to the larvae, which occupy one habitat, the unbounded space of the sea, while reproduction is the task of the adult, which is most often a

stay-at-home bottom dweller. What a contrast to the insects, where the unfettered flying adults are the agents both of dispersal and reproduction, while larvae are the sedentary ones carrying on the metabolic housekeeping for the species.

Recourse to a metamorphic way of life is not by any means restricted to invertebrates. Living representatives of some of our earliest ancestors, unlikely-looking marine animals commonly called sea squirts, undergo remarkable metamorphoses. Sea squirts, more formally tunicates, are small, saclike animals; most live attached to rocks, coral reefs and wharf piles. They are members of the phylum Chordata, however, the same phylum to which we belong. Tunicates are characterized by having early in life a long cartilaginous rod (the notochord) extending from head to tail. Tunicates and other primitive chordates such as acorn worms and lancelets have two other vertebrate characteristics, a dorsal tubular nerve cord (our spinal cord) and gill slits as in fishes. But one can look in vain for a notochord in adult tunicates. The fact that there is none caused scientists for the longest time to misclassify these animals. Only when the larvae were discovered was the true nature of the animals revealed.

A tunicate larva is a small tadpolelike animal up to two millimeters long. It possesses a perfectly normal notochord, but for a short time only. After swimming as a free animal for a few minutes, or a few days at the most, it heads down for a hard surface where it stands on its head. In this position it glues itself permanently upside down by means of three papillae on its chin (p.127). It then proceeds to metamorphose. The tail is absorbed, the larval nervous system and notochord are reabsorbed, other larval organs are broken down to be replaced by a set of adult organs suited to a sessile, or sedentary, life. It is an entirely new animal.

While complex life cycles must have enjoyed some adaptive value when they evolved, it is clear that their continuing value depends on a neat balance between the stages being maintained. The more complex they are and the more dependent on a stable environment, the greater the chance of something going wrong. Over the long haul, metamorphosis leads to inherent instability. It is not surprising, therefore, to discover instances in which a particular phase of a life cycle that may have been advantageous at one time is subsequently discarded. In tsetse flies, for example, the free-living larval stage is lost; that is, the larva develops completely within the adult, is laid as a mature larva that never functions as such and which immediately becomes a pupa.

It is in the amphibia, however, that the loss of stages is among the most diverse. Some salamanders are perpetual larvae, no adults ever being produced. In other salamanders and in frogs the reverse may be the case, there being no free-swimming larval stage. But many of our common species of toads and frogs still retain the Jurassic ways; they metamorphose completely.

Spring is the time to observe them, when they congregate in grand choruses to beget not frogs but tadpoles. In nature's world of music, late spring and summer belong to the birds, midsummer and fall to the crickets and singing grasshoppers; spring belongs to the frogs and toads. The ice has hardly left the swamps when the frogs bestir themselves in the mud, the toads in their winter dens, and together crawl into shallow water and swamp grasses to serenade their mates. True love knows no greater sacrifice than to sit up to one's chin in freezing water and sing the night through.

From the moment it emerges from the gelatinous egg similar to pearl tapioca, the tadpole is a creature of the water. It is a swimming vegetarian breathing with gills. Its organ systems are perfectly designed for this way of life. As spring gives way to summer, however, strange things begin to happen. Little hind legs, like Pinocchio's nose, grow longer and longer. The tail begins to shrink. Soon front legs appear. Inside, even more drastic changes are in progress. Lungs are getting ready to replace gills; the long coiled vegetarian digestive system is rebuilt to the shorter system of carnivores; the sense of smell which was most efficient for detecting watery chemicals is reorganized to detect scents in the air. There is now an urge to catch flies, sit on lily pads in the sun and, especially in the spring, sing or at least "chuggarum" on still nights.

The tadpole has become a frog. The metamorphosis is complete. The frog will never become a prince.

A damselfly pulls itself out of the exoskeleton of the swimming naiad it had been all its life—till now.

*By Russell Warren Howe*

# Mournful fate of Mata Hari, the spy who wasn't guilty

*New evidence indicates that the World War I siren was executed because her death was convenient to German and French intelligence*

Last pictures of Mata Hari were these mug shots, taken in Saint-Lazare shortly after she was arrested.

Shortly before 5 A.M. on October 15, 1917, a party of 18 men, most of them army officers, stomped down a second-floor corridor of Saint-Lazare, the women's prison in Paris. Led by a male warder carrying a flare to light the lamps, they stopped at the door of Cell 12.

Nuns did most of the guard duties in the prison, and so it was Sister Léonide who opened the door. She cautioned the official party to stay in the doorway as she struck a sulfur match against the wall to light the gas lantern. Then she sat down on the cot and put her arm around the shoulders of the still-sleeping inmate.

Mata Hari stirred and leaned on one arm. Her face, swollen by eight months of confinement, made her appear older than 41. She no longer looked like one of the most famous courtesans of the Belle Epoque.

Her glance sought Edouard Clunet, her 74-year-old lawyer, but he was too distraught to speak. It was the military prosecutor who had prepared the case against her, Capt. Pierre Bouchardon, who said gently but firmly: "Have courage! Your request for clemency has been rejected by the President of the Republic. The time for atonement has come."

Still leaning on one arm in her iron cot, she blinked and said: "It's not possible! It's not possible!"

Sister Léonide clasped her by the shoulders and held her close as Mata Hari said, "Don't be afraid, Sister, I shall know how to die."

Later that morning, Mata Hari was executed by firing squad as a German spy. The records of the investigation and the secret trial were ordered sealed for 100 years. Debate over the issue raged for decades. Was she, as her prosecutor proclaimed, "the greatest woman spy of the century"? Had she been responsible for the deaths of "hundreds of thousands of Allied soldiers," as the French and British newspaper stories said? Was she simply shot, as many believed, to silence her, because the trial revealed treachery and corruption in high places in France? These and countless other theories, embroidered by a vast literature of exuberant mythology about the seductress-spy, have flourished in books, the press and film. In the absence of the investigation and trial papers, all hypotheses were permissible.

After four decades in political journalism, I wanted to write a biography of a historical figure who had not tried to run a country. Two years ago I saw a photograph of Mata Hari in all her splendor—dressed in an hourglass corset and a turn-of-the-century ball gown. So far as I could recall, hers was a mystery that had never been solved. Hers was also the best-known spy name in history. She had slept with lovers on an almost industrial scale while managing to perform her vocation of courtesan with a certain élan. After reviewing the literature, I discovered that opinion was indeed still divided as to her guilt or innocence of espionage.

"I am a woman who enjoys herself very much," she wrote from cell; "sometimes I lose, sometimes I win."

Through personal connections, the French Minister of Defense agreed to let me see the secret dossier on Mata Hari. What I read did not conform to anything that I had suspected or to any of the theories propounded by Mata Hari's defenders and detractors. I reviewed nearly 500 items, mostly handwritten notes in the judicial file. My research revealed an intriguing picture of the German and French intelligence services inadvertently working together to achieve a common goal—the elimination of Mata Hari—and a trial in which the prosecution never called (and the court never allowed the defense to call) the two witnesses who could have proved or disproved the case against her. Though Mata Hari admitted she took money from a German intelligence officer who assigned her a code name—"H21"— there is no evidence that she gave anything but gossip in return. She conceded she had accepted the money, but only because the Germans had mistreated her, and she swore that she was not a professional spy. And in fact, all that was proved during the trial was that Mata Hari was a free-lance agent who committed espionage only once—for the French.

Margaretha Geertruida Zelle was born in Holland on August 7, 1876, the eldest child and only daughter of Adam and Antje Zelle. Her father was a pretentious man, a hatter who wore garish clothes, her mother a penniless member of the petty gentry. Although of Frisian and North German descent, Margaretha had black hair, brown eyes and an olive complexion, and would later claim to be half-Indian or half-Indonesian.

When she was 13 her father's business failed, and with it his marriage. The once doting father became bad-tempered and estranged from his daughter. Her mother died shortly before Margaretha's 15th birthday and the children were sent away to live with relatives, Margaretha with her godfather. It was then that the tall (five-foot-nine), gawky, yet vivacious young woman discovered that she was attractive to men. The headmaster of her school fell conspicuously in love with her; at 18 she was withdrawn from school and sent to stay with other relatives in The Hague.

*Finding a husband through a newspaper ad*

There, feeling restless, she responded to a newspaper advertisement that read: "Captain in the Army of the Indies, on leave in Holland seeks wife with a character to his taste." The man was Capt. Rudolf MacLeod, and three months after meeting they were married. They spent most of the next seven years of what proved to be a miserable cohabitation in the Dutch East Indies (now Indonesia). There her two children were poisoned, apparently by a native servant, and the older one, a boy, died. The MacLeods quarreled violently and continually, and were separated soon after they returned to Holland in 1902. Rudolf abducted their daughter, whom Margaretha would see only once, very briefly, again.

Now nearly 27, she set off for Paris to start life anew as an artist's model. Failing swiftly at that, she returned to Holland, where she met a free-spirited French diplomat, Henri de Marguérie, who was about to return to Paris. She became his mistress and decided on a new career—"Hindu" dancer. Marguérie introduced her into the salons of Paris as a "sacred" performer from a Ganges temple. She imitated the dances she had seen in Indonesia, adding a striptease which she pretended was part of the temple ritual. An instant success, she took the name Mata Hari—"the light of day" in a dialect spoken in Indonesia.

From 1905 until the outbreak of war in 1914, Mata Hari enjoyed mixed success as a dancer, alternating between prestigious appearances in Madrid, Milan, Monte Carlo and Paris and less distinguished performances in old-people's homes and a vaudeville theater in Sicily. But as the founder of striptease in Europe, and above all as the paramour of some of the era's most famous men, hers became a household name.

Her lovers included Jules Cambon, France's leading diplomat; the Crown Prince of Germany; the com-

In Paris, Margaretha Geertruida Zelle sought fame as a "Hindu" dancer, so she changed her name to Mata Hari.

poser Massenet; and scores of others. She had few real friends, but for 11 years she and Marguérie tumbled into bed whenever his career brought him back to Paris.

The attraction of Mata Hari was, of course, her brazen novelty. She had made stripping artistic, exotic—and acceptable. But there are just so many times that one can repeat the same act. As other exponents of naked dancing appeared, she would harp righteously on the artistic and "religious" nature of her dancing.

What had brought her to Paris in the first place was the disintegration of her marriage and the destitution created by the separation. Although she enjoyed her fame, and enjoyed it immensely, she had not come to Paris to conquer the stage but to move up from poverty to luxury. The obvious way to do that was marriage to an affluent and attentive husband. Playing Salome in a sarong, and even on horseback, was only a means to an end. Her artistic career began to falter, and as market forces started to challenge the momentum of her faddish, shooting-star career, she decided to make more permanent arrangements. From 1910 to 1912 she became the mistress of a French banker. But when her lover's bank collapsed, she returned to Paris.

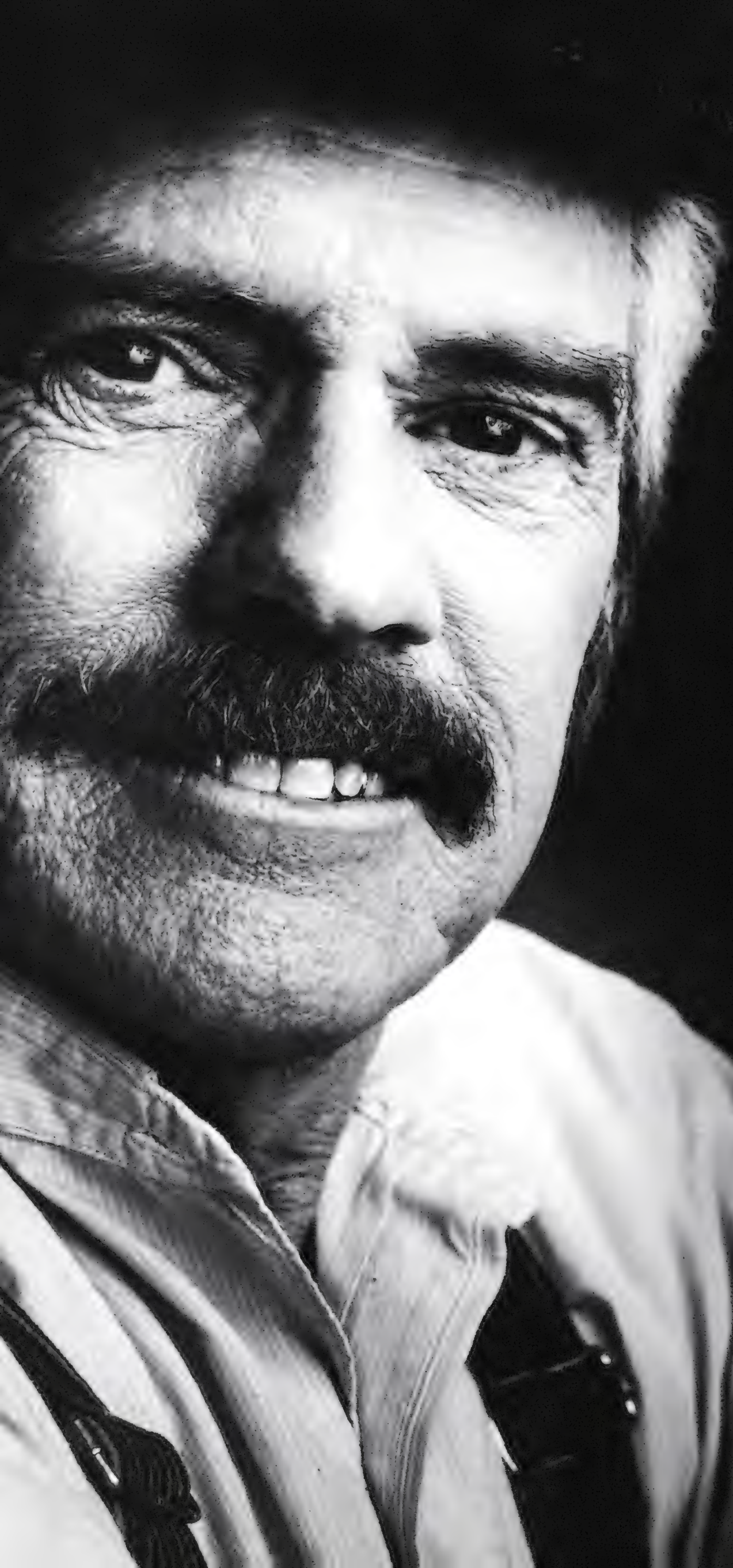
Unable to find another permanent "protector," and with her stage career at a standstill, she went to Berlin in May 1914. She danced at the Metropol and had a liaison with a city police officer who had quashed a charge brought against her for indecency. It was an affair that would prove to have fatal consequences.

In August of that year, World War I began. Mata Hari could have returned without trouble to her neutral homeland, Holland, but her request to return to Paris—now enemy territory—resulted in her bank account, furs and jewelry being seized by the Germans. So, penniless, she returned to Holland where the one-time "toast of Paris" gave two final performances —both one-night affairs.

There, at 38, the fading courtesan and failed dancer fortuitously encountered a former lover, a baron, who set her up in a charming town house in The Hague, well away from his wife in Amsterdam. Had she stayed there throughout the war, her name would have become only a minor footnote to history, as the pioneer of striptease dancing, and would never have been associated with espionage.

However, bored and impulsive, unable to stay in one place let alone with one man for very long, she journeyed to Paris for a three-week stay over Christmas in 1915. There she would see old lovers and find new ones. Her arrogance and self-centeredness precluded her realizing that the war was changing all of Europe and that someone as conspicuous and well-known as Mata Hari would be noticed wher-

*This article is adapted from Russell Howe's* Mata Hari, The True Story, *published this month by Dodd, Mead.*



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ever she went. The occupation of Belgium had forced her to travel through England, where she came under the watchful eye of the British intelligence service. Aware of her earlier visits to Berlin and her dalliance with the German policeman, the British grew suspicious and passed on to the French their conclusion that she was a German agent.

When she returned to Paris again a few months later, she was followed by two French police inspectors in civilian clothes, who found no evidence of espionage activities. Aware of but ignoring the surveillance, she spent, in fact, six sybaritic months in the beleaguered city. Her reason for staying was that she had done something no courtesan is supposed to do: she had fallen in love.

In the salon of a retired actress, Mme Dangeville, Mata Hari met Vladimir de Masloff, a 21-year-old Russian captain serving with the French army. They became lovers but "Vadim" soon had to return to the

Her marriage to Rudolf MacLeod was miserable and lasted only seven years.

*"Oh beautiful city*
*steeped in sentiment as she lies,*
*Spreading her gardens to the moonlight,*
*And whispering from her towers*
*The last enchantments of the Middle Ages."*
—Matthew Arnold

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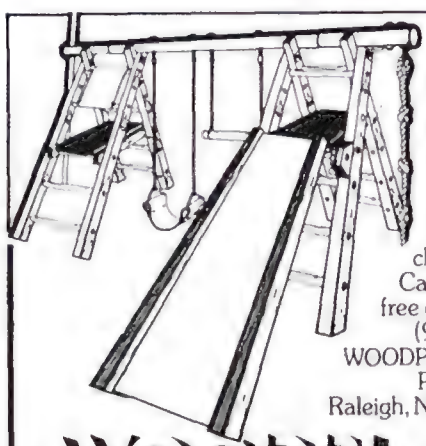

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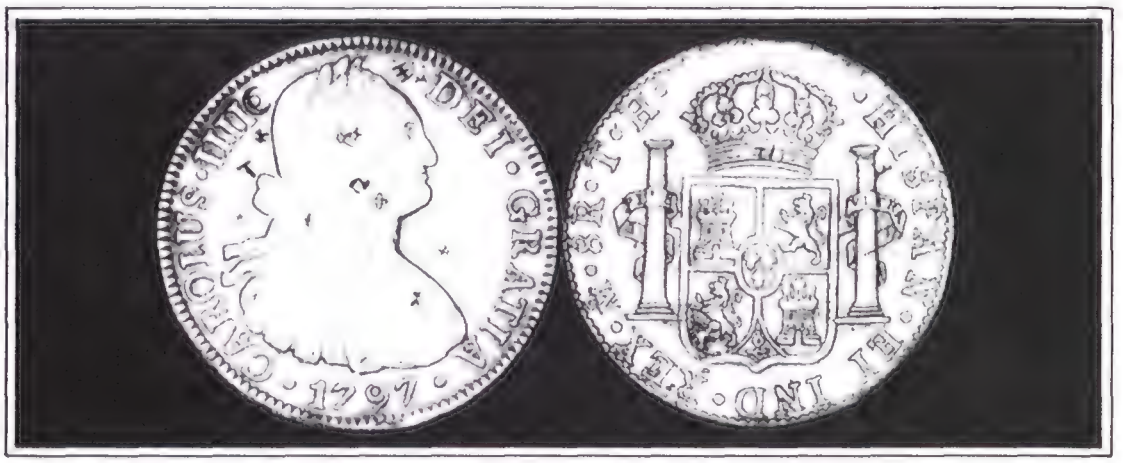

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Front. There he was mustard-gassed by the Germans and lost the sight of his left eye. This battle-scarred youth, with his halting French, awakened something in the aging Mata Hari. For all her adult life, she had relied for her existence on men more affluent and usually older than herself. Now, she set out to become the protector of a much younger man, giving him part of her allowance from the Dutch baron to pay his gambling debts and buy him expensive meals.

The mutual attraction is not hard to understand. She was now rather fat and very forty—and finished as a dancer. The chances of marriage with a wealthy lord were fading fast. But as proof that she was still irresistible, she had won the passion of a handsome and dashing boy who was responsible for the fate of perhaps 100 soldiers. Nor is it hard to see the relationship from Vadim's side. Although Mata Hari was past her prime, she remained a name, an image. As a trench-warfare officer with a life expectancy of five months, Vadim found that he had not just acquired a famous mistress but a mothering figure as well. Their shared passion was to transform Mata Hari's life—and to

Vladimir de Masloff, 21-year-old Russian captain, became Mata Hari's last lover.

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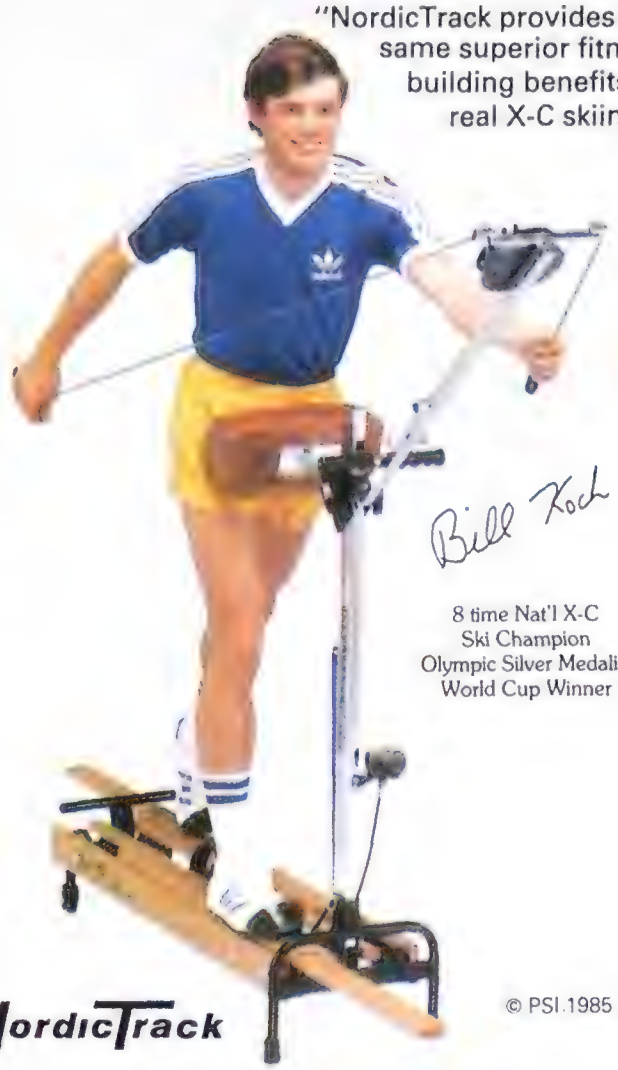


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cause her death, through a chain of unfortunate circumstances.

It started when she wanted to visit Vadim, then recuperating at a hospital near Vittel in the war zone. The trip required a special pass, and her numerous efforts to procure this permit led her to the man who would become her nemesis. His name was Georges Ladoux, a career army captain who had come out of St. Cyr, the West Point of France. A short, trim, black-bearded figure with a waxed mustache and brilliantined hair, Ladoux was a protégé of the overall commander of French forces. He had the job of organizing counterespionage in spite of his modest rank of captain, which gives some idea of the embryonic nature of the intelligence service. Indeed, that he was still a captain at 42, in the middle of a war that offered rapid and easy promotions to fill dead-men's shoes, suggests that he may have had a troubled military career.

A friend proposed that Mata Hari meet with Ladoux about her permit. In his memoirs, Ladoux recalled the encounter: "It was in August 1916 that I met Mata Hari for the first time and I can see her still, as if it were yesterday, dressed, in spite of the summer weather, in a dark two-piece and wearing a large-brimmed straw hat with a gray feather." She swung her hips "like a dancer" as she walked in.

By then the British, whose "Secret Service" Ladoux believed to be vastly superior to the French intelligence organization, had told him they were convinced that she was a German spy.

And so when the famous Mata Hari came to him to ask a favor, Ladoux must have realized that he had hit a jackpot. If the British suspicions were correct and she was a German spy, he was in an excellent position to turn her to the French side, making her in effect a double agent. If she was not a German spy, he might still be able to make use of her to gather intelligence for the French. In any case he would be able to test her loyalties.

At their meeting, Ladoux asked her if she could use her international contacts to spy for France. She replied that she would consider it if the pay were good. So Ladoux issued the carnet allowing her to visit her young Russian lover in Vittel. It would be a passport to doom.

Vittel was the first test. If she spent her time with Vadim instead of gathering military information for the Germans, Ladoux was prepared to hire her as a spy. She could certainly use her German contacts and language skills to pretend to the Germans that she was one of theirs—or *still* one of theirs, if the British theory were correct.

According to police reports, during the week that she spent with Vadim in Vittel she engaged in no suspicious activities. And so when she returned to Paris, Ladoux formalized the arrangement: Mata Hari would spy for France. She told him frankly that she was undertaking the work solely for the money. She wanted to spend the rest of her life with Vadim and would need a substantial sum since he would be dependent on her. "I want to be rich enough not to have to deceive Vadim with others," Ladoux quoted her as saying.

Ladoux retired as major after the war, was named Inspector of Resorts and Spas.

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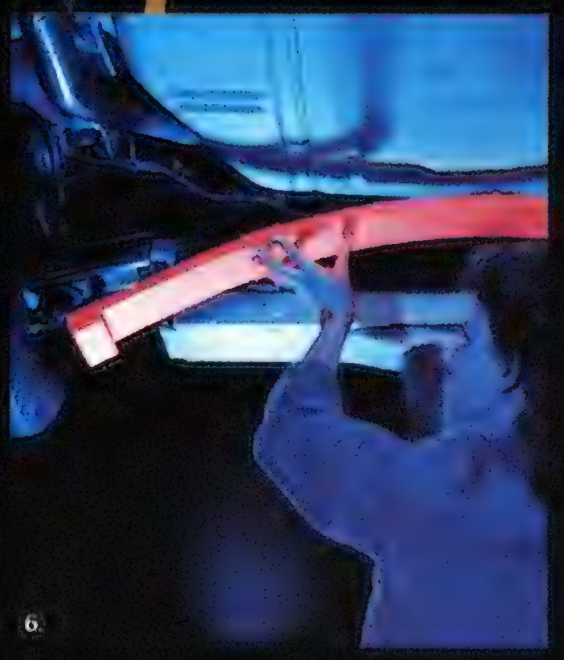

6.

Once again the irrepressible woman was determined to set her own agenda. She did not want to waste her time with small, nonremunerative assignments, so the amateur spy had soon mapped out what she could do for the French in Belgium, her first assignment.

Her plan was to contact a former lover who had promised to introduce her to the German officer who commanded the occupation forces in Belgium. She would seduce the general and work her way back to the Crown Prince in Berlin. Soon France would be learning, via her pillow, everything that was going on at the highest levels of German planning. When Ladoux asked her about payment, she said that she wanted a million gold francs if she succeeded. Ladoux suggested she go back to The Hague, where he would have an agent contact her. It was agreed that she would return via Spain.

She spent the night of November 6 in Madrid, then traveled the next day to board the *Hollandia* at Vigo. The ship put in at Falmouth, Cornwall, where the British came aboard for the usual search of the cargo and passengers. An overzealous constable arrested Mata Hari, mistaking her for a known German spy to whom she bore a superficial resemblance. Taken to London, she was interrogated at Scotland Yard. She decided to tell one of the high-ranking inquisitors that she was working for Ladoux, but when queried, Ladoux cabled back that he "knew nothing" about such a relationship, adding "Send Mata Hari back to Spain." One explanation for his disavowal may be that the British arrest of his probationer spy might have made him look foolish to them. They had already made clear their suspicions of her.

After three days, her interrogators at Scotland Yard seem to have realized that she was a bumbling amateur and released her. She left England and returned to Spain, where she wrote a letter to Ladoux explaining her misadventures and asking for fresh instructions. He did not reply.

Prewar Mata Hari wore latest fashions and was supported by series of lovers.

The two weeks that were the basis for her later trial for espionage were now about to begin.

It was the second week of December 1916. Mata Hari was still without instructions from Ladoux, in need of money and unable to leave Madrid to get to Holland and Belgium. Stranded in a neutral capital, she believed she could still impress Ladoux by spying on the Germans there. She selected the name of a German military attaché, Maj. Arnold Kalle, and secured an appointment at his house.

There seems little doubt that Kalle correctly recognized her from the start as a bumbling *agent provocatrice*. At one point during their first afternoon together, Kalle told her he was tired because "I am busy trying to arrange for a submarine to drop off some German and Turkish officers in the French zone of Morocco." That night Mata Hari wrote to Ladoux about the meeting, passing along the submarine story and the name of a German agent Kalle had also given her. As it happened, Ladoux already knew about the submarine, and the information on the German agent turned out to be false. Clearly Kalle was stringing Mata Hari along by what French espionage calls *intoxication*—a poisoning mixture of lies and true but stale information.

During two more afternoon meetings, Kalle supplied more information which would already have been known to French intelligence.

Some of these "indiscretions" seem to have been planted to see what was getting back to the French. And Kalle probably wanted to reassure this naive would-be spy that she had fooled him into thinking that she was on the German side at heart. Being Mata Hari, she probably attributed his apparently unguarded remarks to her extraordinary powers of seduction. She ingratiated herself with the German major by feeding him her own diet of *intoxication*—items culled from gossip and the French press. For this he paid her 3,500 pesetas, a small amount of local currency.

Mata Hari had now been a French spy for three afternoons and had, she thought, acquired important intelligence. It was time to return to Paris to be paid for what she saw as her swift success. She arrived on January 4 and found Ladoux unwilling to see her—nor was there any news from Vadim at the Front.

Early 1917 was the beginning of a year of desperation for the Allies, and especially for France. The war remained stalemated and the outlook was grim. Ladoux's protector and chief of staff had been replaced—indeed, in the space of a year France would have four overall commanders. From February to June of 1916, France had held onto Verdun but at a cost of 350,000 French lives, and the political front was in disarray.

It was, in short, a dangerous time for a woman in Mata Hari's compromised position to be in Paris. To make

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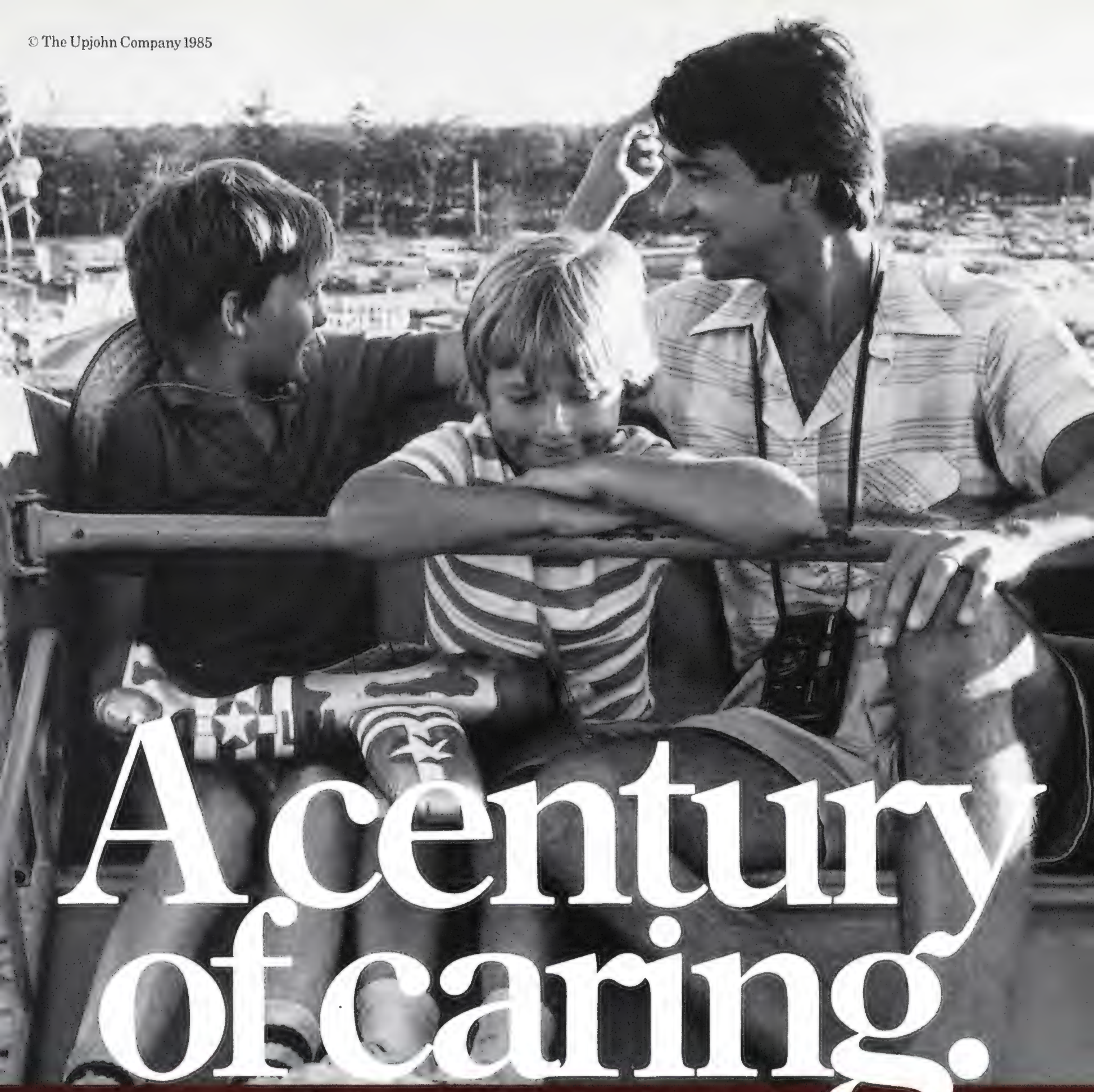

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matters worse, when her beloved Vadim finally joined her for a few days, he brought disquieting news. His commanding officer had been instructed by the Russian embassy in Paris to warn the young captain that he was dealing with a notorious "adventuress."

For the next several weeks she tried in vain to reach Ladoux, finally being told he was absent in the South of France. She became restless and desperate, her money once again running out—in part because her Russian gigolo was proving to be expensive.

But she was in much more trouble than she knew—due to a series of intercepted messages encrypted in a broken cipher. Indeed, it was the use of this broken cipher that would both seal her fate and provide powerful evidence of her innocence.

Early in the war, the British had broken the German cipher and had shared their information with the Allies. By 1916 the Germans realized that their cipher had been compromised and devised a new one. But late that year the Allies penetrated that one as well—although the Germans still believed it to be secure.

Which brings us to December 13, 1916. On that day, while Mata Hari

Studio portrait of Mata Hari and young Russian lover, Vadim, was done in 1916.

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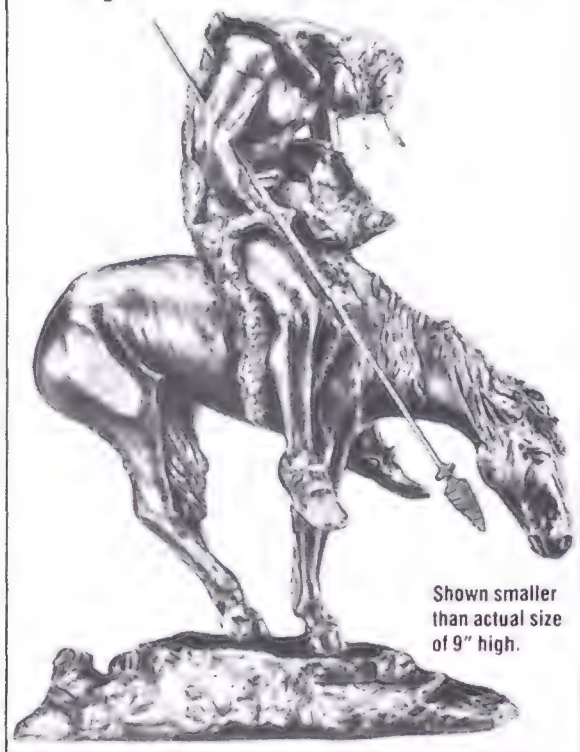

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To Bouchardon, Mata Hari wrote: "Everywhere I have met scoundrels and honest men . . . I defend myself when they attack me."

was still playing spy in Madrid, the radio-monitoring devices on the top level of the Eiffel Tower intercepted a message in cipher from Major Kalle in Madrid to his superiors in Berlin. The deciphered message was delivered to Ladoux. It began, "H21 informs us" and passed on Mata Hari's scuttlebutt and gossip items. Ladoux recognized this as the sort of Paris information that must have come from Mata Hari; but what alarmed him was the prefix. The Germans had given her a code name, H21. Since her assignment was to be accepted by the Germans as one of them, this would normally be an achievement. However, for the code name to be understood in Berlin, she must have received it before Ladoux had given her the assignment.

Another series of intercepted German messages asked questions about Mata Hari's information; this too might indicate that she had been working for the Germans all along. Thus by mid-December Ladoux was presumably convinced that Mata

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Hari *was* a German spy—which may explain why he kept refusing her requests to see him. But instead of arresting her immediately, he continued the surveillance. Perhaps she would even lead the two inspectors shadowing her to a whole network of German spies in Paris.

However, in mid-January Ladoux was given a major piece of information he should have had when the first messages were intercepted the month before—information that might have saved Mata Hari's life if only Ladoux had revealed it.

The point was this: all Kalle's messages and Berlin's responses were in the broken cipher—the original one that the British had decrypted early in the war and that the Germans *knew* the Allies possessed. Therefore all the messages were *meant* to be read by the French. All the traffic about H21—who is clearly Mata Hari—appears to be a bluff meant to persuade the French to arrest their agent and shoot her.

At this stage Ladoux should have had reason to suspect that Mata Hari was innocent and being set up by the Germans. Why he took the course of action he subsequently followed can never be known. Perhaps it was simply that he felt the arrest of the famous Mata Hari as a spy would be a great coup. Then, too, the climate of the times may have had something to do with it. As victory on the battlefield was proving elusive, shooting as many spies as possible would at least show that the government and the military brass back in Paris were doing something to protect the soldiers at the Front. Pressure to catch still more spies was even coming from the French President's office.

On February 13, 1917, Mata Hari was arrested "for espionage, attempted espionage . . . and intelligence with the enemy, for the purpose of promoting their interests." She was taken to army prosecutor Pierre Bouchardon's office before being taken to prison.

During her first interrogation she

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was asked if she had read the warrant and she signed a statement which read: "I am innocent. Someone is fooling with me—French counterespionage, since I am in its service, and I have only acted on its instructions."

During my review of the interrogations of Mata Hari in the dossier, it was clear that Mata Hari had recounted the events in her life in a way to make it appear more respectable. She mixed up dates and exaggerated facts—so it seems she was not yet aware that she was in no position to play games. Discrepancies made her entire explanation look bad. Her arrest was kept secret and she was not allowed to contact friends—not even Vadim. She took on as her lawyer one of her former lovers, Edouard Clunet. The 74-year-old attorney was singularly unsuited to defend a criminal case in court, especially in a military court. He was regarded as an expert in international corporate law, but he had not pleaded in court for years.

Bouchardon's case against Mata Hari was not as strong as it might have been. He was aware she had given information to Kalle in Madrid, but he had not yet been told about the Madrid-Berlin intercepts, presumably because doing so would have revealed the closely held codebreaking abilities of French intelligence. Bouchardon did possess a receipt showing that 5,000 francs had been sent to her in Paris, and he was told that a "secret document" indicated that it was from the German intelligence service. Actually, the receipt was for money sent to her by the Dutch baron who had helped support her for several years.

In interrogations during the next month, Bouchardon would endlessly go over all the details of Mata Hari's life, catching her constantly in mistakes and trying to force her to confess. To make things worse, on March 6, 1917, the Germans, once again using the broken cipher, queried Kalle

Capt. Pierre Bouchardon (left) interrogated Mata Hari, then turned the case over to Lt. André Mornet, who prosecuted her at the trial.

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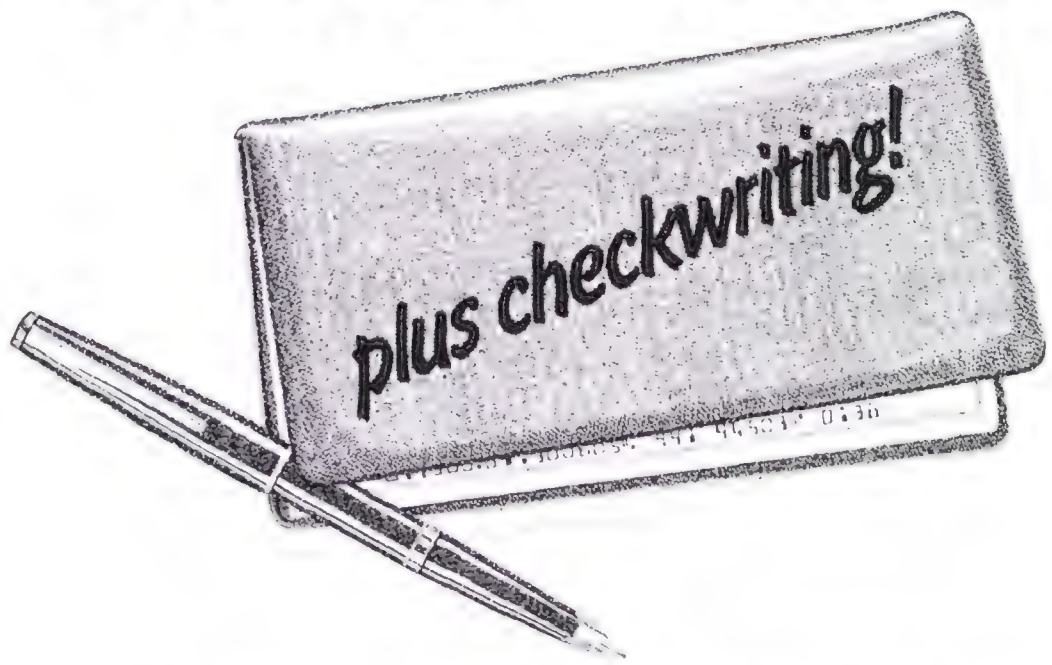


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about the work of H21. At this point it is important to ask why the Germans were still sending messages in the broken cipher. The Kalle traffic may have been *intoxication* aimed at French intelligence. If Mata Hari had actually been working for the Germans, Berlin would certainly have known of her arrest. Why would they be trying to contact her in Madrid two months after her departure?

It seems probable that the Germans did know of the arrest and were attempting to load the case against her. Even further, they may have wanted to convince the French that they, the Germans, were so inefficient as to not know of the arrest of their own spy.

From her rat-infested cell Mata Hari pleaded to be released. She began a long series of letters to Bouchardon explaining over and over what had happened in Madrid. She also claimed it was absurd to accuse her of being pro-German. After all, at the outbreak of war the Germans had treated her "like an animal" and had seized her valuable furs.

And now Captain Ladoux decided to give the investigation a push. He would reveal the Madrid-Berlin messages to Bouchardon—but leave out all mention that the transmissions were in the broken cipher. Ladoux notes the messages had been in "the German cipher" and therefore "in passing these documents to the pretrial phase, I draw your attention to their importance and to the grave inconveniences which divulging them would present for the National Defense." He asked that the military court be instructed accordingly and that its hearings be held in secret. He appeared sure there would be a trial.

When confronted with the evidence of the intercepted messages, Mata Hari was unable to fight back adequately. Under the judicial rules, her lawyer was not allowed to be present. However, through his almost daily contact with her, he learned most of what was discussed during her interrogations. Clunet asked to

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have the baron and her longtime maid from Holland interviewed so they could confirm that the suspicious 5,000 francs she received had come not from the Germans but from the baron. Permission was denied. Thus Clunet could not interview the two people who could help her most.

Clunet finally requested a meeting with Ladoux and Bouchardon, claiming that Mata Hari had more information to reveal. By this time she had been questioned repeatedly and it was clear, even to her, that she must tell everything she knew. She recounted an incident that occurred late one night in May 1916. She had received an unexpected caller at her house—Kroemer, the German consul in Amsterdam. He knew she was going to France and asked if she would gather information there for the Germans. He offered her 20,000 francs. She reminded herself that the Germans had seized her furs worth far more, and decided it would be fair enough to take from them what she could. He came back later with the money. At this time, Kroemer assigned her the code name H21—the name later used in the Madrid-Berlin messages. She never communicated with Kroemer again.

Turning to Bouchardon, she said she had not revealed all this to Ladoux the previous year because she had intended to make her recruitment into the German intelligence service her first mission for France after returning to Holland. Now, it is easy to speculate as to why the Germans wanted her shot by her own people. She had taken the Germans' money, done nothing for them and gone to work for the French. Getting her arrested and convicted would be a great coup against the French intelligence service. Where she had been foolish had been in accepting money from German intelligence in the first place.

Mata Hari admitted that she had acted recklessly, but she reminded her questioners that she was not a professional spy. "I have always lived for

Greta Garbo was guilty of espionage in title role of 1932 MGM film *Mata Hari*.

love and pleasure." The 14 interrogations had not changed the minds of Ladoux and Bouchardon. They were determined to put her on trial.

Bouchardon transmitted his voluminous papers and his summary of the case to prosecutor André Mornet. A wartime lieutenant and a seasoned and theatrical lawyer, he was to become one of the best-known government attorneys of his generation. On July 24 the trial opened at the Palace of Justice. Mornet got the court cleared of public and press.

The national atmosphere in which the trial took place was dramatic, and Mornet, a thin, bearded figure, took full advantage of it. The Germans were not exactly at the gates of Paris, but the city had been declared a "retrenched camp." The battlefield carnage had by then become the greatest in history and remains so to this day. Public and military morale were poor. Eager to place the blame on others, the government had countless foreigners arrested on suspicion of espionage; more than 1,000 had been expelled. About 500 were charged with spying, and before the war was over nearly 300 would be executed. Mata Hari's was only one case among

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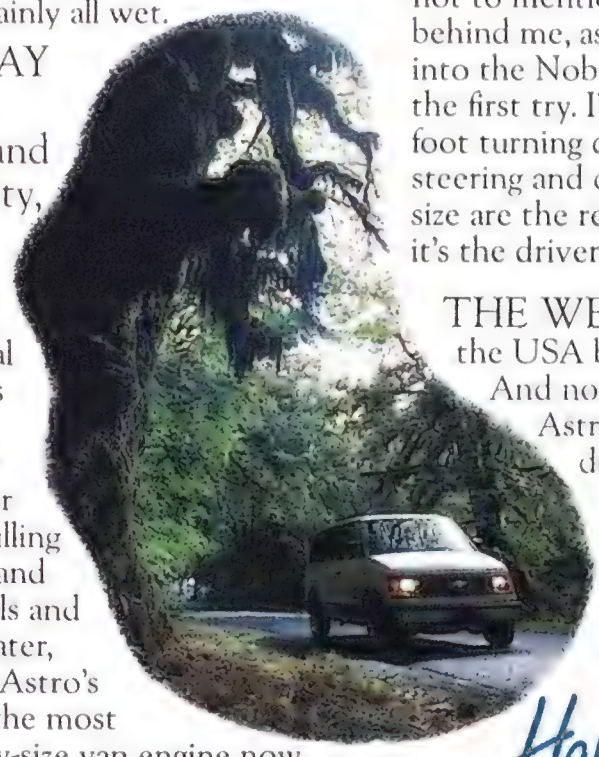

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many. The campaign against "foreign spies" gave the impression that the battlefield reversals were not the fault of the French but of insidious foreigners in their midst.

Mornet laid out the case against the defendant. He described the "discreet surveillance" conducted on her in Paris, which revealed that she consorted with many officers. She had continued to have such trysts at Vittel, and on her return to Paris. He recounted her attempted trip to Holland, her arrest in Britain. Then he told of the intercepted radio messages from Madrid that showed she was agent H21.

Mornet told the court: "The Zelle lady appeared to us as one of those international women—the word is her own—who have become so dangerous since the hostilities. The ease with which she expresses herself in several languages, especially French, her numerous relations, her subtle ways, her aplomb, her remarkable intelligence, her immorality, congenital or acquired, all . . . make her suspect."

He detailed every last bit of conversation she had had with Kalle about France. Curiously, he described the Berlin policeman as her true lover and portrayed him as a major figure in German intelligence. He concluded with a stirring reminder of soldiers dying at the front by the hundreds of thousands, betrayed by spies. "The evil that this woman has done is unbelievable!" he cried. "This is perhaps the greatest woman spy of the century."

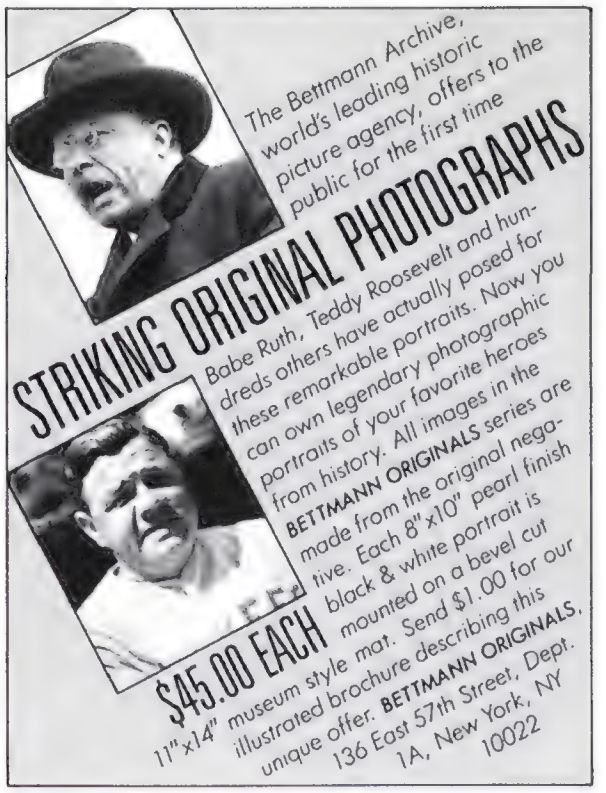
The defense could neither cross-examine hostile witnesses nor question its own directly. The defense witnesses were called the following day. Mata Hari had decided against calling Vadim because it would make her cry and "there would be nothing that you could do with me." She asked for other witnesses but few appeared—most found pressing reasons not to be there. A letter was introduced from an old flame, Gen. Adolphe-Pierre Massimy, the former Minister of War,

now serving at the Front, who wrote that at no time had the accused ever discussed the war or military affairs with him. The only other friend to testify on her behalf was her longtime lover Marguérie. Three hours of the afternoon were taken up by Clunet's plea for the defense. No trace of this remains in the files. The judges withdrew to consider the charges.

After about 40 minutes, the court found Mata Hari guilty on all eight counts, including charges that she spied in 1915 and 1917, for which no evidence was presented.

After reviewing the files, this writer has come to his own conclusions: Mata Hari made only one effort at espionage and this took place in Madrid—for the French. She spent three afternoons with a German military officer who fed her inaccurate information and to whom she passed along gossip items from newspapers. She did receive money from the Germans but there is no evidence that she gave them any information in return. None of her actions provided evidence for eight counts of espionage. She was deliberately framed by the Germans, who used a cipher that they knew the French had already broken. All the German spymasters' memoirs and the official histories of German espionage in World War I seem to be in agreement: Mata Hari never was "one of ours."

Curiously, four days after Mata Hari was executed, Capt. Georges Ladoux was arrested for spying for Germany. He had been accused by one of his own agents, who protested that *his* actions as a double agent had been misinterpreted, that the Germans must have set him up. Like Mata Hari, he was ordered to name his accomplices. She could name none. He named Ladoux. Ladoux's arrest was kept secret because it would have been contrary to the success of the war effort if the most senior figure in French intelligence turned out to be a German agent. After the end of the war and victory, he was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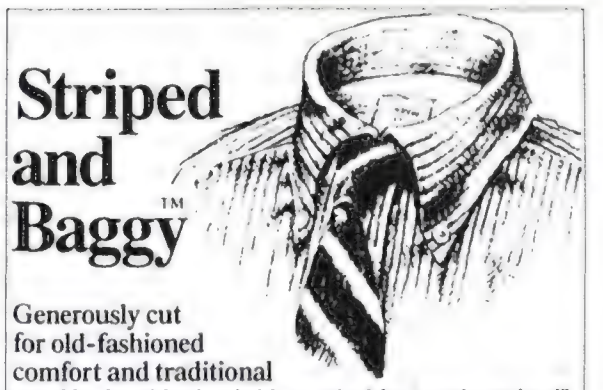
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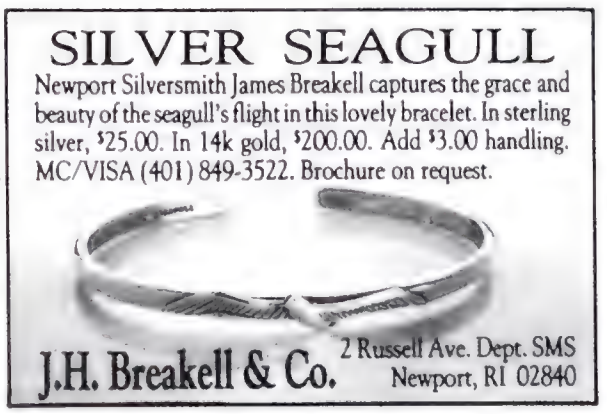
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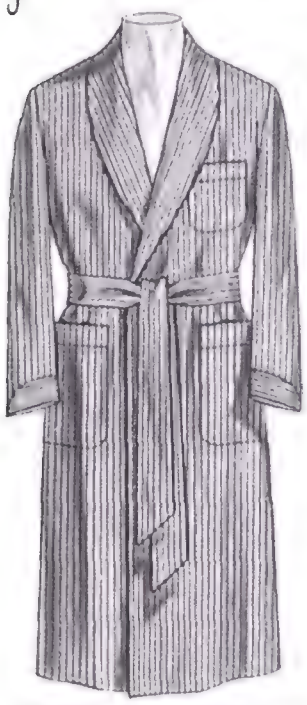

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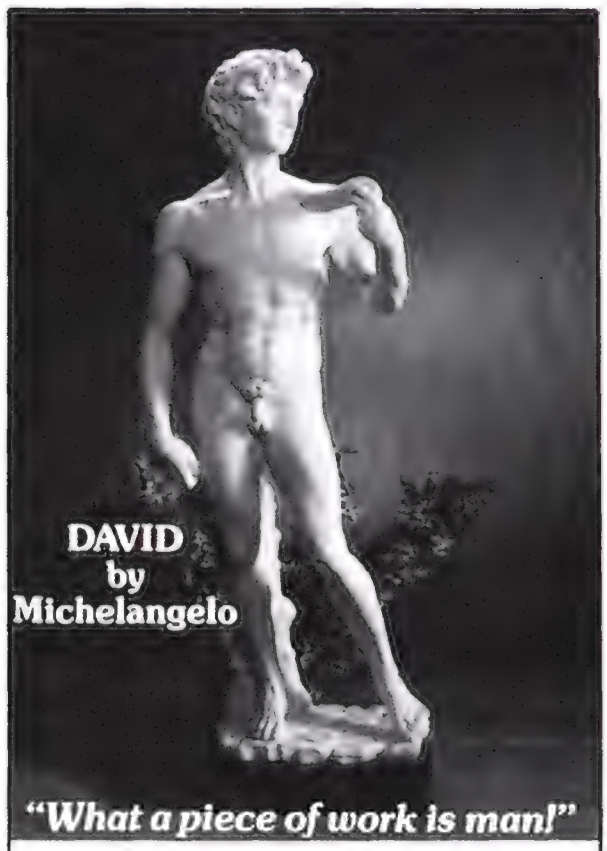


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court-martialed and acquitted. The Ladoux dossier is still sealed, so without knowledge to the contrary it is only fair to assume that his acquittal was justified. Had he been arrested sooner, one can only hypothesize as to the stunning effect it would have had on Mata Hari's case.

Early on the morning of October 15, 1917, Mata Hari slowly selected clothes for her execution. From the limited wardrobe she had been permitted to keep in prison she chose a pearl-gray dress with a wide skirt and a lace *cache-corset* at the bosom, a tricorn felt hat and elegant buttoned shoes. Before putting on the hat, she asked the Baptist prison chaplain to baptize her. Soon it was time to go.

She put on her hat and primped her wavy, graying black hair, cut short according to prison rules, and drew on long gloves, buttoning them to the elbow. She threw a blue coat over her shoulders. When the male warder moved to take her arm, she brushed him away saying, "I am not a criminal." She accompanied the execution party down the steps to a ground-floor office where she asked to write three letters—to her daughter, to Vadim de Masloff and to the Baron de Marguérie. None of them arrived and none is in the dossier.

In the street, the drivers started to crank the cars. The crowd outside the prison gate fell silent as the party emerged, with all eyes fixed on the tall woman. A gendarme led the way for Mata Hari and Sister Léonide to a large sedan. The convoy moved off, heading for the old castle-palace of Vincennes and its Caponnière, a broad field usually reserved for cavalry displays. As the cars bumped across muddy hummocks, Mata Hari could see troops assembled.

A bugle call alerted the soldiery, who began straightening their uniforms and forming up.

The stake was clearly visible, the limb of a young tree thrust into the ground. The firing squad, 12 soldiers of the 4th Zouave Regiment, stood

The scene of Mata Hari's execution was solemnly reenacted for a French silent film that was made in 1922.

waiting in formation. With the two women in front, the entire execution party walked past a battalion of troops standing at attention.

The command rang out: "*Sabre-main!*" Then "*Présentez-armes!*"

The sabers flashed, pointing at the somber sky. The captive walked briskly past, literally reviewing the troops.

As they drew level with the Zouaves, Mata Hari kissed the nun and gave her the coat from her shoulders. A sergeant major came to lead her but she turned her back on him, walked to the stake alone and swung around gracefully to face the Zouaves.

The chief military court clerk, a captain, read the sentence of death. The sergeant major looped the cord around her waist. He was about to bind her wrists to the stake.

"That will not be necessary," she ordered. He pulled the blindfold from his lanyard, but Mata Hari shook her head imperiously. As he marched off, he muttered to the young lieutenant in charge of the riflemen, "*Parbleu*, this lady knows how to die."

The pale young officer had been given his assignment the night before and told to choose enlisted men of all ranks so they could have the pleasure of shooting a German spy. But he was uncertain as to how the battle-shocked young conscripts would react to the order to shoot a woman, so he had selected 12 mature sergeants.

He raised his saber. "*Joue!*"

The Zouaves lifted their rifles to their stubbled cheeks. The sublieutenant turned his face reflectively toward the target. The captive returned his frightened glance and said clearly, in a voice which all could hear: "Thank you, sir." She lifted her hands and blew a kiss to the firing squad, then turned her head slightly, and smiled.

As the saber came down, one of the Zouave sergeants fainted; 11 shots rang out. The prisoner crumpled. From where he stood, Bouchardon could see only "what looked like a heap of skirts."

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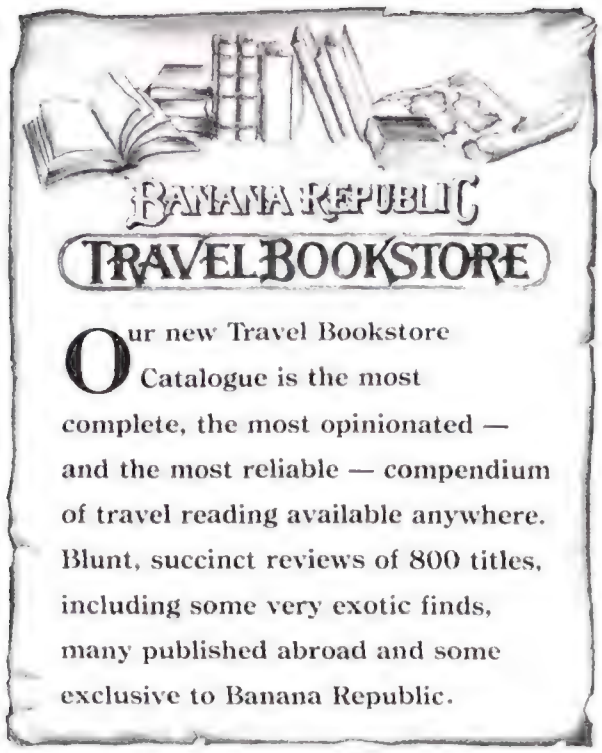
When Ernest Hemingway showed up at the *Toronto Star* in 1920, he was an eager 20-year-old whose name had never appeared professionally in print. By the time he handed in his last article for the Canadian newspaper four years later, he was a seasoned foreign correspondent and a versatile writer, well on his way to becoming the novelist who changed the pace and rhythm of English prose.

Now, 25 years after his death, *Dateline: Toronto* goes back to Hemingway's beginnings. It brings together for the first time all of the 172 pieces he wrote for the *Daily Star* and the *Star Weekly*, and an extraordinary collection it is. (Twenty-nine of the articles appeared in William White's 1967 book, *Byline: Ernest Hemingway.*) The stories range from features on dentistry and shoplifting to terse dispatches from the Greco-Turkish war and a long, gripping description of the running of the bulls in Pamplona, later the setting for his first novel, *The Sun Also Rises.*

Hemingway never ranked his reporting with his fiction, but his work for the *Star* was fine stuff. "And much of it," as editor White notes, "can still be read both as a record of the early Twenties and as evidence of how Ernest Hemingway learned the craft of writing."

Right from the start, he was a good newspaperman. The talent showed in his first bylined story, a funny, informative and concise 1,000 words about getting a free shave at a school for barbers. (His next piece lampooned the mayor.)

And the *Star* was good for Hemingway. It was an aggressive and demanding paper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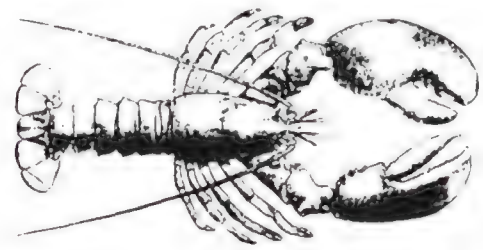

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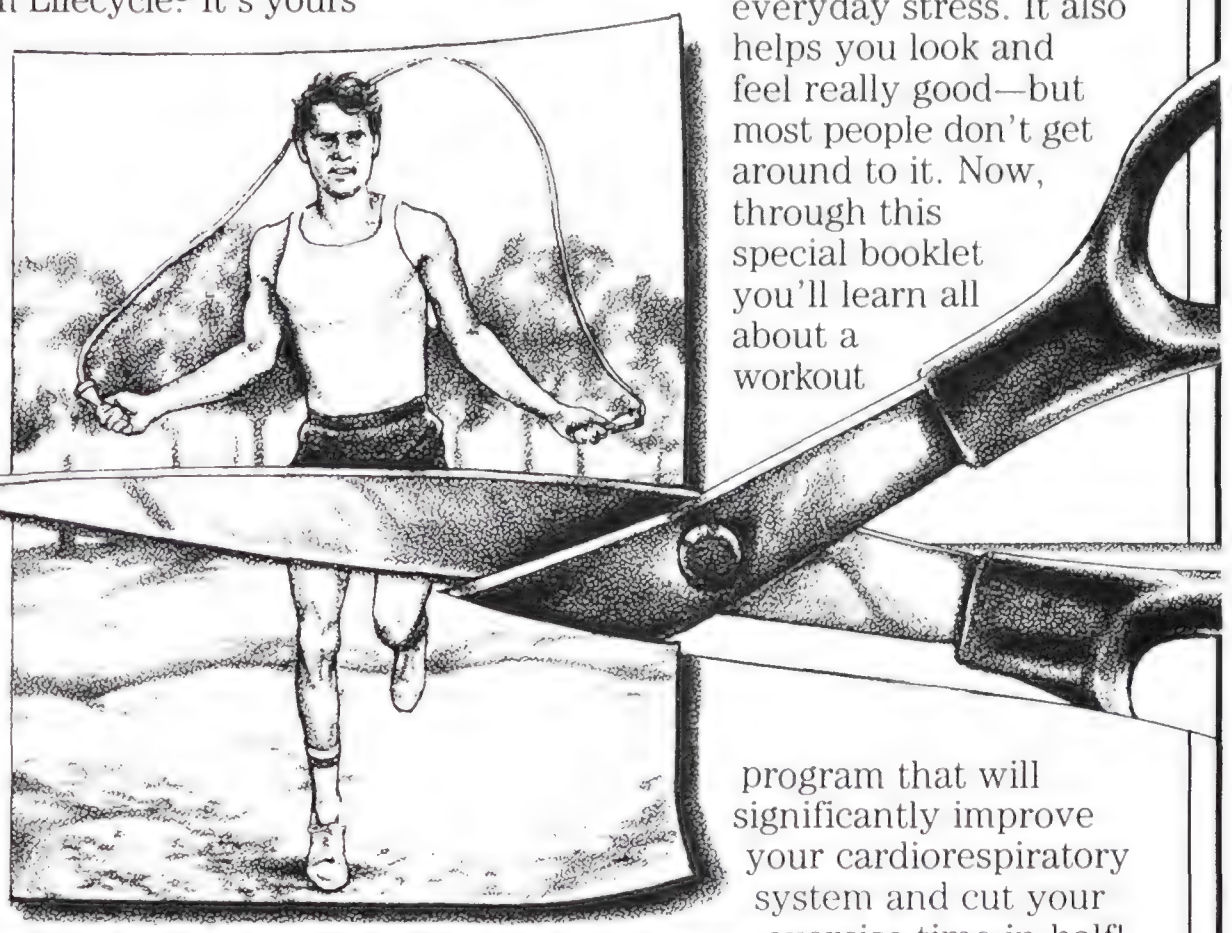

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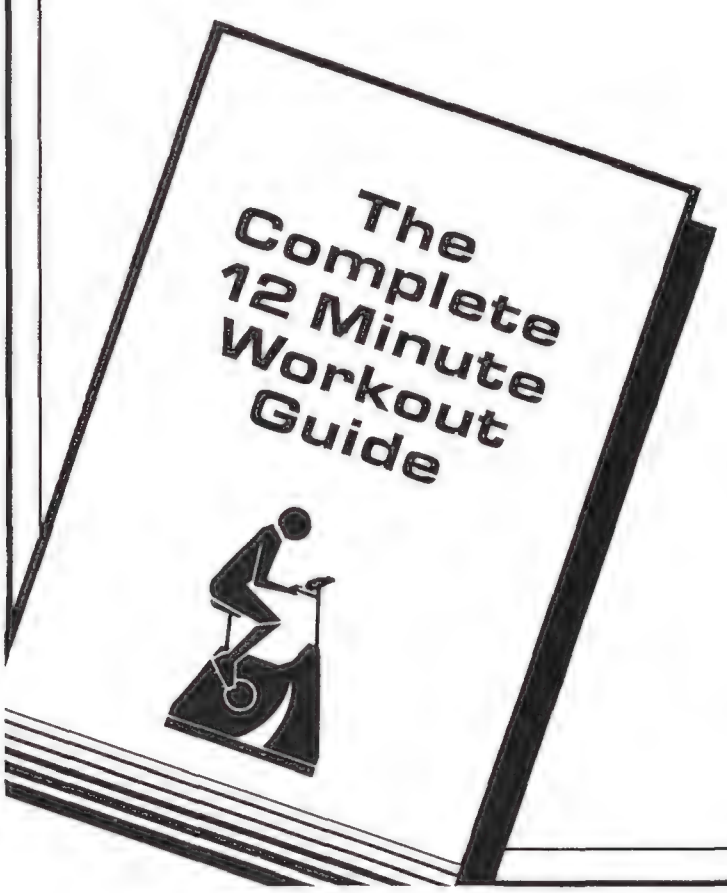


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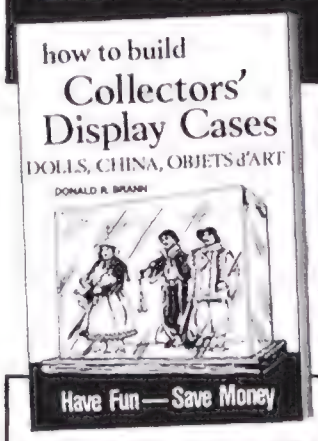


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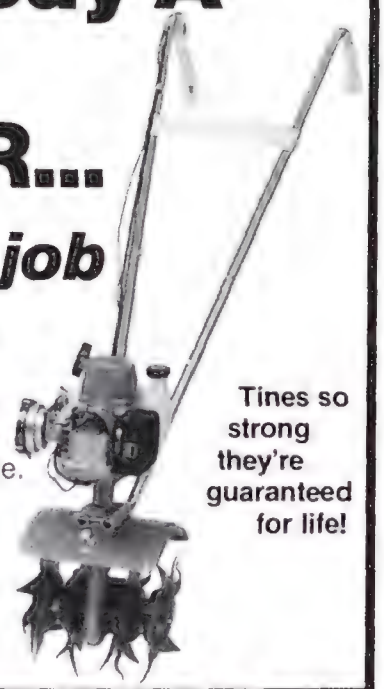

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whose editors encouraged reporters to write in their own style, and its weekly magazine supplement gave Hemingway the space he needed to work out for his later short stories. It paid him enough to live on (about $45 a week near the beginning) and financed his first stay in Paris.

Part way between Hemingway's Michigan woods and abroad, Toronto was as good a place as any to start; Babe Ruth had hit his first pro home run in the Canadian city—in 1914, for the Providence Grays—and Hemingway, too, was swinging for the big leagues. After 32 of his stories had appeared in the paper, he married his first wife, Hadley, and set out for Paris.

His foreign dispatches show the Hemingway style sharpening—the crisp images and the deceptive simplicity—as he wrote about life and politics in Europe. He wrote about fishing and bobsledding, too, and when the *Star* sent him to an economic conference in Genoa he quickly spotted the Fascist threat to Italy, resourcefully covered the Soviet delegation and later interviewed Mussolini ("the biggest bluff in Europe"). He revisited the front where he was wounded in World War I, he went to Constantinople and described the Greek retreat in the Balkans and he reported on the simmering tensions of postwar Germany. Then, after a trip to Spain, the Hemingways returned to Toronto—where he found himself reduced to writing about a search for coal in northern Ontario. *Dateline: Toronto*'s one defect is that it gives no background on any of the articles and no explanation of why Hemingway's fortunes

War hero Hemingway recuperates from wounds received rescuing an injured soldier.

Photography: Sean Morgan

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had faded at the *Star*. Fortunately, before he quit the paper, he turned his 20 months in Europe into several more memorable stories, including "Christmas on the Roof of the World," which six decades later still seems as fresh as the Alpine morning it describes. On New Year's Day 1924, Hemingway left the *Star* to go back to Paris and take his chances as a writer. He won —we all won.

*David Lancashire*
*Globe and Mail*, Toronto

*Bird of Life, Bird of Death:*
*A Naturalist's Journey Through*
*A Land of Political Turmoil*
Jonathan Evan Maslow
Simon and Schuster, $17.95

So transporting is Jonathan Evan Maslow's graceful and imaginative nature writing that he needn't travel far to bring us life's hidden mysteries. Such was the case with his first book, a sharp-eyed collection of essays on Strigiformes, *The Owl Papers* (Dutton, 1983). To meet the night birds up close and personally, Maslow braved dumps, deserted parks and toxic-waste sites at the midnight hour. But he never ventured far from his New Jersey home.

This time round, Maslow chose a far more exotic venue, Guatemala, and as avian quarry, the resplendent quetzal. His is a poetic if uncomfortable choice: to seek the Maya symbol of liberty in a country ravaged by civil war and oppressive dictatorship.

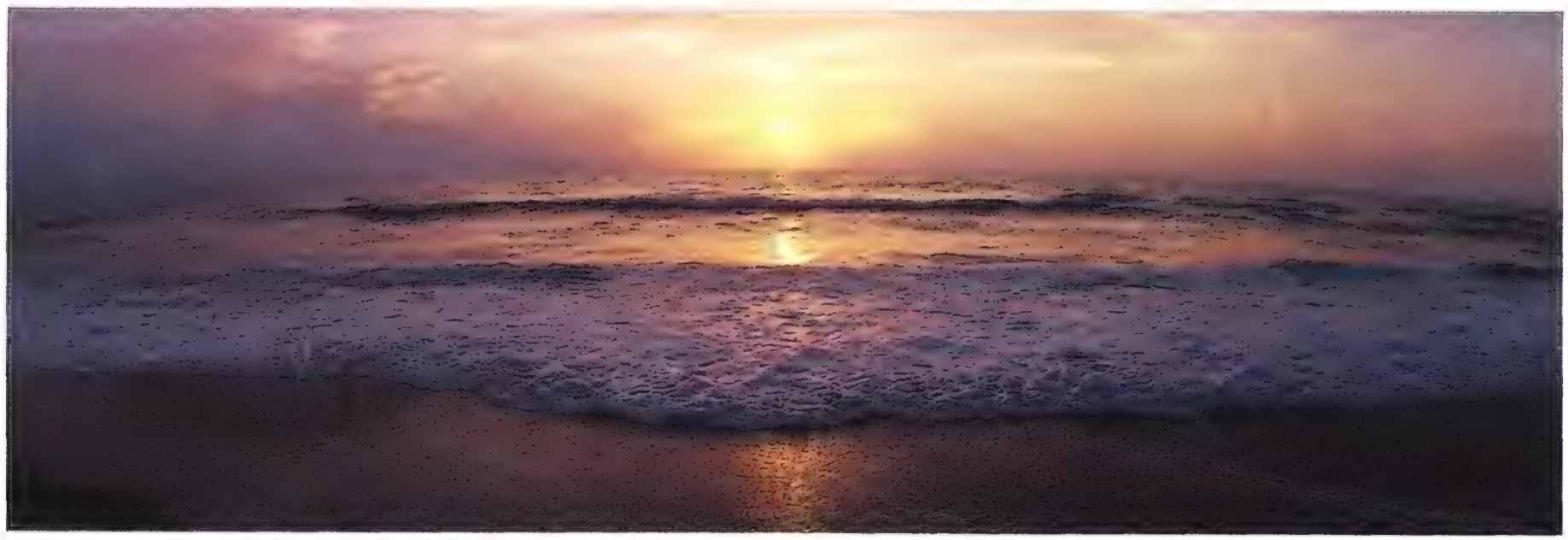
Under such conditions the quetzal's renown can only contribute to its decline. As drily stated in the International Council for Bird Preservation's *Endangered Birds of the World*, the quetzal "has been designated the national bird of Guatemala, although the consequent notoriety tends to result in its regular appearance in captivity rather than to provide added protection."

There are, however, rarer birds than the endangered quetzal, even in the fast-shrinking highland forests of Guatemala. But in a realm of many handsomely adorned and monickered species—emerald toucanets, blue-crowned euphonias and azure-hooded jays among them—none can rival the gleaming green and red plumage of the quetzal. As Maslow describes his first sight of a male quetzal, waving its huge tail as it crossed a road, "His colors ignited in the sun, emerald green changing to golden green, then to an iridescent green that defies any name but Quetzal green."

The quetzal quest consumes Maslow with nearly equal if less violent passion than it did Osbert Salvin, the 19th-century British naturalist who confessed that his desire "to see and shoot" a quetzal "has been a day-dream for me ever since I set foot in Central America."

Yet we don't come upon the quetzal until well into the book and far into Maslow's weeks-long search in the Guatemalan cordillera, long after he and the reader have become excruciatingly familiar with a species better adapted to contemporary Guatemala: the excrement-eating bird of death, the black vulture, zopilote.

The zopilote is as central to Maslow's diary as the quetzal, for what he seeks is a sense of the country that embraces these avian antipodes. And he has found it in his travels with a carefree American photographer, encountering birds of many feathers: menacing soldiers, bumbling bureaucrats, brave and benighted naturalists. And most sadly and anonymously, the forlorn and forgotten Indians. "Crippled, blinded, stunted, disfigured, ragged, urbanized Indians weaving through the traffic lanes trying to sell Chiclets or afternoon papers,

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Maslow's impressions of natural splendor and human debasement constitute "a kind of essay in political ornithology." But as a social portrait in opposites, *Bird of Life, Bird of Death* veers toward extremes itself. Maslow circles with emotional excess over the grim realities of Guatemalan life. The skies are "full of rolling zinc- and obsidian-colored thunderheads" at the Guatemala City dump where Maslow urges an urchin, "Go to the United States. As soon as you get old enough, go. Walk through Mexico, if you have to, but get out of here."

Yet Maslow's accounts of quetzal hunting and the rich history of Maya culture reveal a more mature and informed passion for the land and its people. Not surprisingly in a naturalist, Jonathan Maslow is more at home celebrating life than castigating death.

And he so radiates resplendent talent and youthful curiosity that he should continue his travels even farther from home. It is to be hoped that publishers will keep sending Maslow afield on wild-goose chases or thylacine hunts or after whatever hidden living treasure appeals to his gentle, intrepid spirit. He's sure to return with a splendid trophy.

*Don Lessem*
Naturalist and writer

*Jonathan Swift, A Hypocrite Reversed: A Critical Biography*
David Nokes
Oxford University Press, $24.95

Jonathan Swift's biographers have spent a good deal of time quarreling with each other because they cannot reach a consensus about the nature of his literary achievement or even about simple factual questions: Was he married? Did he go mad in his last years?. This is hardly surprising, for Swift's character is extraordinarily enigmatic and paradoxical.

Though born an Irishman, and at times given to strongly Irish patriotic sentiments, he spent much of his life seeking political and ecclesiastical offices in England, and when he was made Dean of the Anglican St. Patrick's Cathedral, Dublin, in 1713, he felt he had been sent into exile. "I reckon no man is thoroughly miserable unless he be condemned to live in Ireland," he had once remarked. But of course as an Irishman Swift was not fully at home in England either.

David Nokes, a lecturer in English at King's College, London, has carefully studied the career of Swift, one of the most gifted of all 18th-century British writers, and in this new biography he offers a vivid portrait of both the man and his age. Swift was an incredibly prolific author, but what makes many of his minor writings so unintelligible today is that they are crammed with references to political figures and events that must seem terribly remote to modern readers. It is misleading to think of Swift as the dignified author of several classics of English literature; he was in fact a ferocious pamphleteer who wrote—almost always in response to public events—some of the most ruthless political satire ever composed in our language.

Only occasionally did he rise above this journalistic style, but when he did so he produced books of great and enduring power. His one universally acknowledged masterpiece, *Gulliver's Travels* (1726), has been variously regarded as an amusing children's story, a parody of the seafaring adventure tale and (by scholars) as a subtle allegory filled with obscure allusions to


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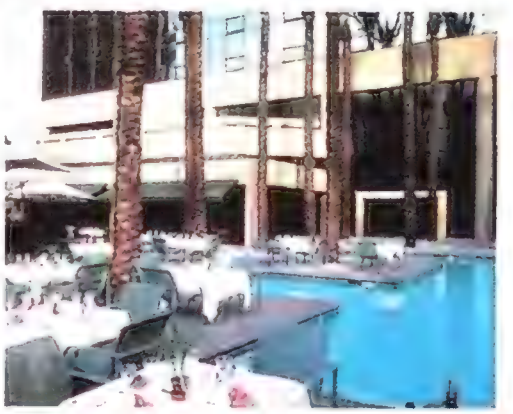

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18th-century political intrigues and personalities. Nokes sees it as a hymn to rationality, yet with tragic overtones, for by the end of the book Gulliver, once the very model of reasonableness, is teetering on the brink of insanity, overwhelmed with disgust at the bestiality of the human race.

Nokes displays great tact in narrating some of the more problematic episodes in Swift's life. How, for example, can a biographer do justice to the conflicting evidence about his alleged secret marriage to "Stella" (Esther Johnson)? Some Swift scholars regard it as the central event of his life; others deny that it ever happened. Nokes very sensibly steers a middle course: he assumes that Swift did marry Stella, but he makes every effort to separate fact and legend. "At this point the story becomes largely a matter of anecdote and tradition," Nokes writes. "There have been several critics of the following account, which cannot therefore be offered as a matter of fact, but it remains still the most plausible explanation of the enigmatic relationship between Swift and Stella." Nokes quotes Thomas Sheridan's story of the marriage.

There is another sense in which Nokes' *Jonathan Swift* can be seen as a skillful compromise. Modern literary biographies tend to fall into two categories—the scholarly and the popular. Nokes has attempted to bridge this gap because, as he rightly points out, we must remember that Swift regarded specialization, especially of an academic variety, as "a first dangerous step towards that distorted simplification of complex human phenomena which characterized the views of all factions and fanatics." Swift himself is as complex, brilliant and unpredictable a phenomenon as one is likely to find in any century. In his book, Nokes has done full justice to his very difficult subject.

*William S. Peterson*
Professor of English
University of Maryland

*Mayonnaise and the Origin of Life: Thoughts of Minds and Molecules*
Harold J. Morowitz
Scribners, $15.95

A century ago, well-to-do Londoners used to gather at the splendid Royal Society, where they'd listen to men of science speak of advances in their fields, of strange new phenomena such as radio waves and microbes. These conversaziones, with the bejeweled turning out for the bespectacled, epitomized that particularly Victorian activity (these days a seeming contradiction): scientific entertainment.

For several years now, Harold Morowitz, a professor of molecular biophysics and biochemistry at Yale University, has been writing brief scientific essays that are very much in the spirit of a conversazione—earnest but charming, instructive but whimsical, and always somehow optimistic. *Mayonnaise and the Origin of Life* is a collection of 51 of his magazine and newspaper articles, including "The Beauty of Mathematics," "Do bacteria think?", "The Roots of Wisdom" (about an abcess in the jaw of a crony of FDR) and "Bird What?", which describes the wealthy republic of Nauru, a tiny Pacific island where the principal industry is mining guano for its phosphate, to be made into fertilizer.

His specialty, of course, is biology, and his remarkable talent is for revealing how interwoven are the fates of living things with their environments. The making of the Nauruans' precious fertilizer, for example, begins in the Norwegian Sea, where frigid currents pick up phosphorus and


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Although a few articles in the collection are rather dull, most hold a surprise or two. True to form, his title essay begins with an everyday thing but then draws a connection to something sublime—a theory of how, eons ago, the first living cell pulled itself together. A clue: the substance in egg yolks that blends oil and vinegar into mayonnaise is a chemical kin to molecules found in cell membranes. "It is," he once said, "a scenario worth pondering."

*Terence Monmaney*
*Science 86*

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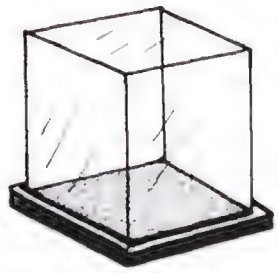

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# *Additional reading*

**The Maya** (p. 38)

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*Maya: Treasures of an Ancient Civilization* (exhibition catalog) by Charles Gallenkamp and Pegina Elise Johnson, Albuquerque Museum, 1986

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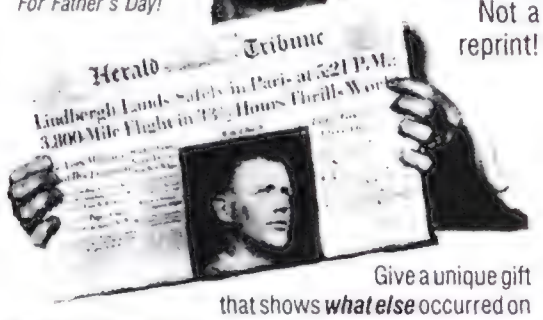


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**Flavoring** (p. 78)

"Educating Your Nose" by William S. Cain, *Psychology Today*, July 1981

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*Jacob and Wilhelm Grimm: The Fairy-Tale Brothers* by Muriel E. Hammond, Dobson Books (London), 1968

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"'Once Upon a Time'. . . . The Brothers Grimm and the Tales They Told" by Ruth B. Bottigheimer, *Wellesley Alumnae Magazine*, Summer 1985

**Metamorphosis** (p. 122)

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**Mata Hari** (p. 132)

*The Murder of Mata Hari* by Sam Waagenaar, Arthur Barker (London), 1964

*Mata Hari: Courtesan and Spy* by Maj. Thomas Coulson, Harper, 1930

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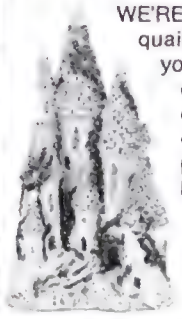

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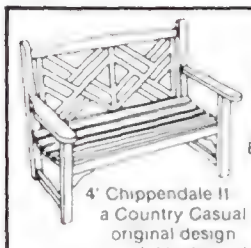

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# *Smithsonian highlights*

On Saturday, May 17, at 9 A.M., a public flight of the radio-controlled pterosaur replica (see SMITHSONIAN, March 1986) will occur at Andrews Air Force Base in Maryland. Gates will open at 8:30 A.M. and a large crowd is expected.

## Planning a Smithsonian visit?

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## Special May exhibits and events

**National Museum of American Art**
*American Figure Prints from Washington Print Club Collections* (May 15-September 14).

**Cooper-Hewitt Museum** (New York)
*Bon Voyage! Design for Travel* (through July 13).

**National Museum of African Art**
*A Human Ideal in African Art: Bamana Figurative Sculpture* (through June 15).

**National Museum of American History**
*Hollywood: Legend and Reality* (through June 15) See *Highlights continued.*
*Graphic Arts: First 100 Years* (opens May 16) History of the museum's Graphic Arts Division.

**National Air and Space Museum**
*Looking at Earth* (opens May 8; continues indefinitely) Views of the planet from balloons to spacecraft.

**National Portrait Gallery**
*Through Light and Shadow: Photographs by Clara Sipprell* (May 23-November 30) Portraits of Eleanor Roosevelt, Pearl Buck, Robert Frost and others.

**Hirshhorn Museum & Sculpture Garden**
*Robert Arneson: A Retrospective* (April 30-July 6) Sculptures, drawings, mixed-media works by this irreverent artist.

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## Resident Associate events

To become a Resident Associate, or to find out about the many other activities presented monthly, or for fee and ticket information, call 357-3030. Here are some May events:
*The Revival of the Russian Spirit* (May 1; 6 P.M.) Author Suzanne Massie explains the


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current reawakening of Russian national life, especially the revival of Orthodox Christianity.

*To-On-Kai: Nagauta Music from Japan* (May 4; 7:30 P.M.) Group of 15 singers and instrumentalists.

*Great Jazz Composers Series: Thelonious Monk* (May 11; 7:30 P.M.) Allen Houser Sextet with vocalist Ronnie Wells.

*Smithson String Quartet* (May 20, 21; 8 P.M.) All-Schubert program.

*Yugoslav Cinema in the '80s* (May 20 and 27; 7:30 P.M.) Films by Emir Kusturica and Branko Baletic.

### Smithsonian on the air

*Radio Smithsonian*: features on this weekly half-hour series include the history of Rural Free Delivery, which first brought mail service to America's farmlands, a look at Frank Lloyd Wright's masterpieces of 20th-century architecture, and a scientific study of Atlantic blue crabs.

*Smithsonian Galaxy*: short radio features explore intriguing aspects of history, science, art and more.

Bamana sculpture show is African Art Museum's last before move to new Quad.


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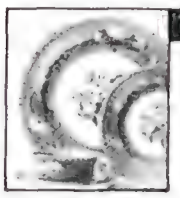

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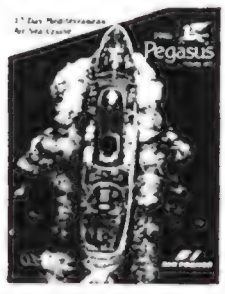


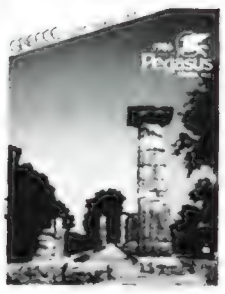


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British travel dressing case, 1875, is in Cooper-Hewitt *Bon Voyage* show.

*Here at the Smithsonian . . .*: three-minute TV features include a look at high-altitude balloon science, an account of the United States Exploring Expedition of 1838 and a visit to the Smithsonian's newly restored Renwick Gallery.

To find out what stations in your area carry these radio and TV programs, write Office of Telecommunications, MAH Room BB40, Washington, D.C. 20560.

### Smithsonian Institution Traveling Exhibition Service

Corning, New York (May 10-June 8) *The Magic of Neon*, Corning Area Public Library.
Fort Worth, Texas (May 24-June 22) *People of the Forest: Photographs of the Maya by Gertrude Blom*, Amon Carter Museum of Western Art.
Grinnell, Iowa (May 10-June 8) *Spectacular Vernacular*, Grinnell College.
Indianapolis (May 17-June 29) *The Laser at 25*, Indiana State Museum.
Midland, Michigan (May 3-June 1) *Beaumont Newhall: A Retrospective*, Midland County Historical Society.
Minneapolis (May 31-June 15) *Peonies of Greece*, Bell Museum.
Tampa (May 10-June 22) *Material Evidence: New Color Techniques in Handmade Furniture*, Tampa Museum.
Tuscaloosa (May 3-June 1) *Marconi*, University of Alabama State Museum of Natural History.
Wausau, Wisconsin (May 10-June 22) *Sculpture: Exploring Three Dimensions*, Leigh Yawkey Woodson Art Museum.


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*Highlights continued*

# American cinema goes Continental

Last month a major exhibition, *Hollywood: Legend and Reality*, opened at the National Museum of American History. Sponsored by Time Inc., organized by the Smithsonian Institution Traveling Exhibition Service and curated by Michael Webb, former director of national film programming for the American Film Institute, its 450 objects will soon travel to five other cities.

The scope of this exhibition is enormous; it encompasses everything from the scarecrow costume Ray Bolger wore in *The Wizard of Oz*, to production designs for *Citizen Kane*, to an original Disney animation cel from *Snow White and the Seven Dwarfs*. But what may be a surprise to many of us is the extent to which American movies were playing in European houses. Nowhere in the exhibition is this better illustrated than in the choice sampling of original foreign posters.

After World War I, the European cinema industry was in a shambles and Hollywood soon became the mecca for immigrant filmmakers and actors. According to one estimate, says Webb, in 1920 four out of five films shown on the screens of the Western world were Hollywood products. In Europe, including Russia, comedies, Westerns and epics drew huge crowds.

Charlie Chaplin, Greta Garbo and Marlene Dietrich had strong followings; in fact, when Europe erupted in World War II it ended Garbo's career, as she had always been more appreciated there than here. Chaplin's *The Great Dictator* (1940) was banned in many European countries. For obvious reasons, it was not shown in Germany or Occupied France; Sweden showed it briefly in 1940, then brought it back for a more triumphant airing in 1946.

Throughout Europe, with its stronger commercial-graphics tradition, movie posters were consistently more interesting than the often action-packed, formulaic counterparts gracing American marquees. "For example," says Webb, "the central madness of *Sunset Boulevard* comes out in the Polish poster [at right] much more strongly than it does in the American posters for that same movie." Although they were made as advertisements and viewed as transitory items, these posters are now avidly collected for their artistic value.

*Constance Bond*

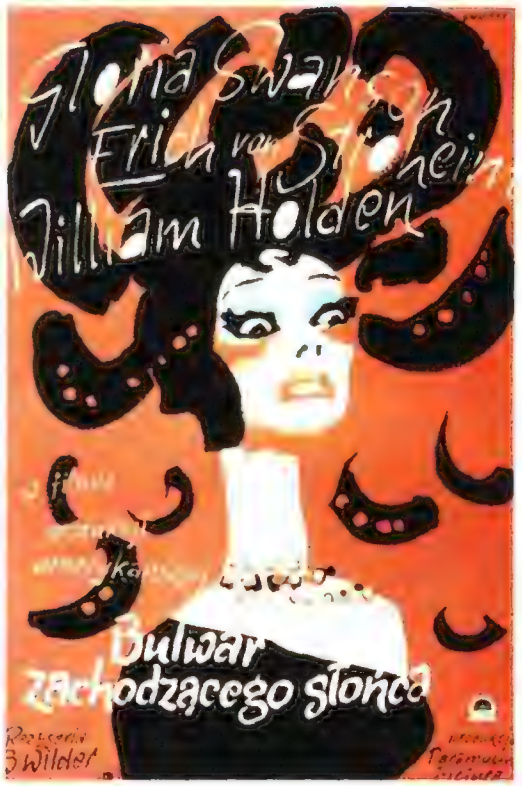
Austrian poster for *Painted Veil* conveyed Garbo's magnetism.

Chaplin film *The Great Dictator* (1940) had a short run in Sweden.

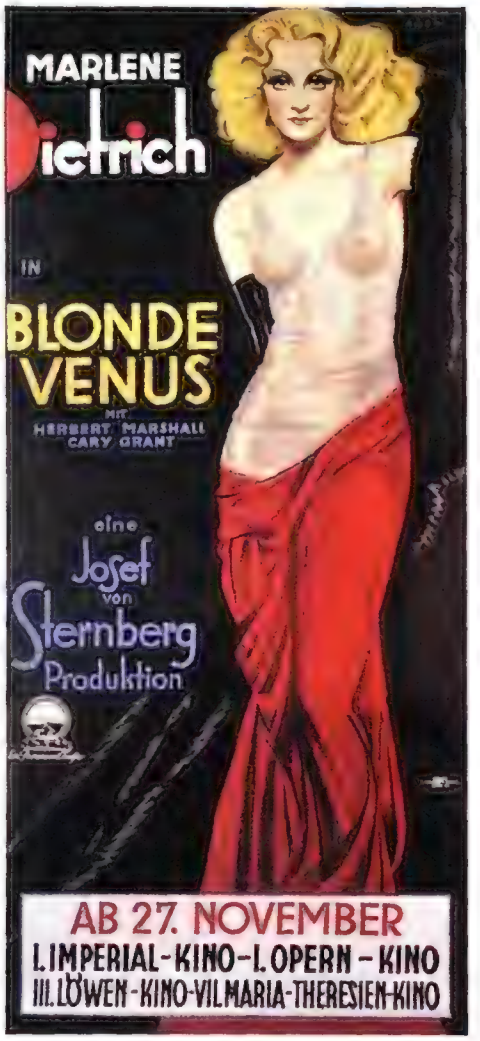
Collage of poster fragments, *Marilyn*, is by Mimmi Rotella.

The French went ape for *King Kong*, a 1933 release.

A Polish poster touted *Sunset Boulevard*, 1950.




*Blonde Venus* appealed to depression-weary Germans.



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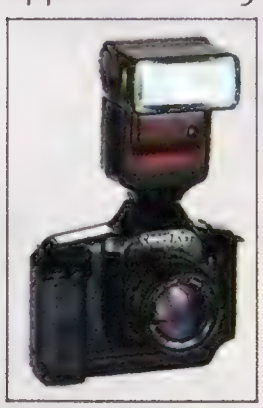

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Grand Canyon July 11-20: Raft with expert boatmen through magnificent landscape.

Waterton-Glacier International Peace Park July 11-22 or July 25-August 5: Experienced hikers tour backcountry with guides.

Oregon July 17-27: Fresh sea air, mountain vistas highlight this outdoor adventure.

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Green River Journey July 30-August 8 or August 28-September 7: Experience the thrill of white water, Utah's canyonlands.

Middle Fork August 5-13: An unforgettable river trip on Idaho's Salmon River.

Colorado Mining and Railroads August 8-16 or September 26-October 4: Relive the Gold Rush days when steam locomotion opened the West.

Crow Canyon Archaeology August 24-31: Join archaeologists near Mesa Verde, Colorado, to participate in a dig.

Utah's Canyon Country September 1-10 or 17-24: Choice of two itineraries to explore red-rock land of deserts, canyons and rivers.

Delta Queen September 11-19: Steamboat adventure from Cincinnati to St. Louis along Ohio, Tennessee, Cumberland rivers.

Treasure Houses of Early America September 20-27: Private tours of Winterthur, historic homes, museums around Wilmington.

Maine September 20-28: Hike rocky coast, inland mountains with naturalist.

Alaska's Inside Passage September 20-30: Cruise from Ketchikan to Seattle: see killer whales and turquoise water of Glacier Bay.

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Paris to Beijing by Train May 30-July 4: Join adventurous fellow Associates for an experience of a lifetime.

Irish Walk June 2-14 or September 5-17: Take day hikes through a variety of settings in the Ring of Kerry and Connemara.

Wild Highlands of Scotland June 5-23: Enjoy the outdoors while studying about this area's cultural and natural history.

Europe by Train June 11-30 or August 13-September 1: Luxury and splendid vistas on *Orient Express*, Switzerland's *Glacier Express*, France's swift *TGV*.

Island World of Britain June 15-July 3: A circumnavigation to explore ancient ruins, great houses and remote hamlets.

Perspectives on Mediterranean Civilization June 22-July 6: Gain new insights into history, art, architecture in Italy, France, Spain, Morocco and Portugal.

England for All Ages July 2-14: Special tour for Associates who want to introduce their families to England. Live in London and Cirencester, enjoy day trips.

Volga Cruise August 19-September 19: Activities in Moscow, Leningrad, Georgia precede 9-day cruise to historic cities.

Crown Jewels of the Hapsburg Empire September 6-21: Explore museums, cultural life in Prague and Vienna with emphasis on Central European art, history.

Oxford/Smithsonian Seminar September 12-27: Be an Oxford Scholar. Attend classes and field trips.

Scandinavian Design Past and Present September 21-October 5: Enjoy a wealth of artistic expression: see museums, galleries, design ateliers, artists' studios.

Black Forest Walking Tour September 27-October 10: St. Moritz and the Black Forest provide spectacular sights for hikers.

**Write National Associates, Capital Gallery 455, Smithsonian Institution, Washington, DC 20560 or call (202) 287-3362 for tour brochures**

# in Washington

## Smithsonian Seminars

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From September 21 through 26, Smithsonian scholars will lead exciting new seminars. In addition to a week of intensive study, participants will enjoy a gala welcoming buffet and an elegant farewell dinner. Hotel is optional.

### Biodiversity

Join Smithsonian scientists and other eminent scholars for a wide-ranging look at the impact of shrinking natural habitats on the world's plant and animal species during the National Forum on Biodiversity, cosponsored with the National Academy of Sciences.

### Native American Cultures

Explore the Smithsonian's collections of native American basketry and pottery as you study the history of American Indian tribal life and visit a Paleo-Indian excavation site in the Shenandoah Valley.

### Music at the Smithsonian

Enjoy the range of musical activities at the Smithsonian, learn about the European and African roots of American music and trace the evolution of theatrical music, spirituals, gospel, blues, ragtime and jazz.

### Aircraft Restoration

Share in the excitement of restoring vintage planes as you attend workshops and demonstrations on woodworking, metalwork and assembly by craftsmen at the Air and Space Museum's Paul E. Garber Facility.

### Smithsonian Seminars at Appalachian State University—June 25-28

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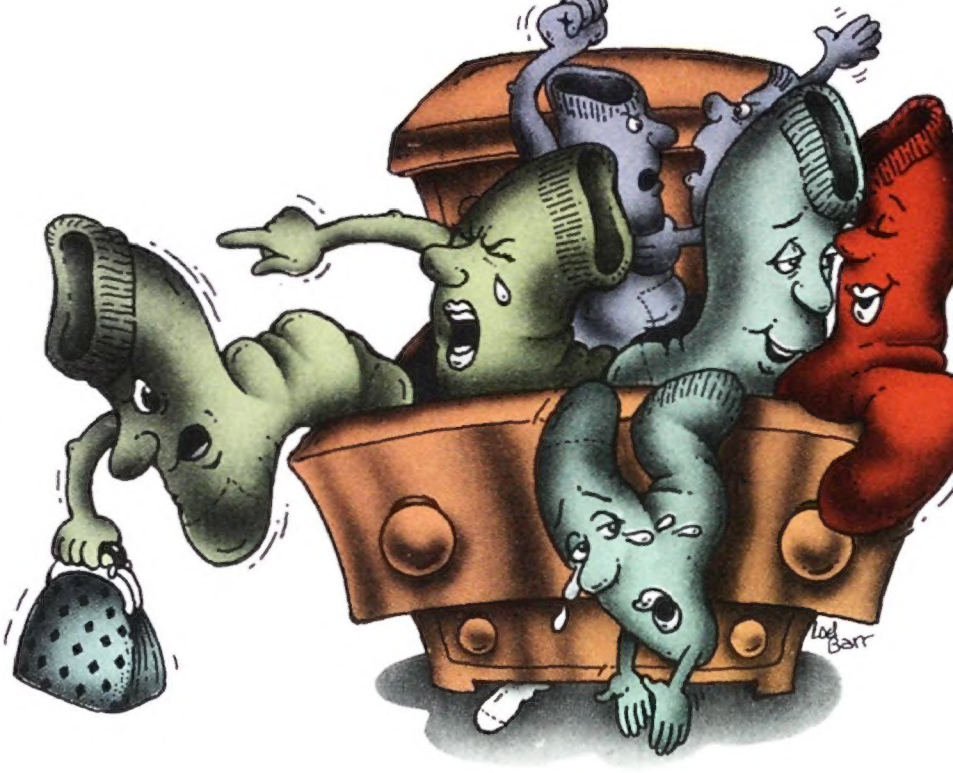
*By Harry Middleton*

# *Those strange goings and comings in the sock drawer at night*



Socks and I have been close companions now for years. I might even say that we have hardly ever been more than a foot apart. But getting along with socks is no easy matter. And I place the blame squarely on the socks.

Socks are troublemakers. No sooner do you buy a pair of socks, bring them home and place them in your sock drawer than they fall into some disagreement or argument and quickly separate. Sometimes one sock is so heartbroken that it vanishes altogether. Meanwhile, the socks left behind go about their timeless ritual—slipping down into the dark bottom of the sock drawer where they multiply, each stray sock producing yet another different sock. They are like snowflakes—no two of them exactly alike. Technology has the answers to many of life's mysteries. But it has no idea why socks separate, each sock traveling its own road five minutes after you bring a pair home.

Modern design has made one improvement, I'll admit. Sulky socks used to punish you by spitefully sagging down around your ankles—unless you were unfortunate enough to wear garters, which cut off circulation in the lower leg. But frankly, I am in favor of fewer tax dollars being funneled into newer and snappier neutron bombs when they could go to sock research. The Pentagon should be interested, too. How safe can a nation be, after all, if none of its soldiers can find a pair of socks that match?

For years I blamed myself, and society, for the incredibly high divorce rate among my socks. Perhaps, I told myself, most socks are ill-matched from the start, come from broken homes, are abused and mistreated. Perhaps it was the shoddiness of my sock drawer or the peculiar aroma of my running shoes that caused the socks to split up. Whatever the problem, my socks simply refuse to stay together. You'd think that if malcontent husbands and wives can stay together, then surely a pair of socks could stick it out, settle their differences, seek counseling. Besides, what have socks really got to complain about? They get plenty of sleep. When they go out they are protected from the elements by stout shoes and pants legs.

Of course, it may be that unlike geese and teenagers, socks are born ungregarious; hating to pair off or travel in groups; rogues, irredeemable loners. This may lead them into petty disputes, rivalries. Years ago I learned never to put athletic socks in with dress socks. The outcome is always ugly. Athletic socks are bullies, always throwing their weight around. Put with gentle-tempered dress socks, athletic socks can clear out the drawer in a week's time, and leave you with perhaps a single blue and black nylon sock. The rest of the dress socks just disappear, only to be discovered later, hidden under the handkerchiefs, slumped under an ottoman, wedged in an old coat pocket or caught smuggling themselves out of the house in my gym bag.

Meanwhile, back in the sock drawer the victorious athletic socks begin bickering among themselves, splitting up, going their own way, gypsies of cotton marked with brightly colored circles of red, blue and yellow thread. The sock drawer is a rough neighborhood, a place where survival is always on the line.

When I first began to notice that my socks were vanishing and showing up with the wrong partners, I thought my son was to blame. "That's it," I told myself, "just some childish prank." I had just caught him skipping off to school dressed in one red sock and one brown. But my blame theory soon proved footless. A quick look in my son's sock drawer revealed that he was no better off than I. A fast inventory turned up one green sock, three orange ones, two that were light blue and six assorted white athletic socks. In a fit of confession my son told me that he had discovered rebellious socks under his bed, stuffed in his bookcase, hidden in his toy box, hanging from his windowsill.

What baffles me even more is that socks seem to have it in for men only. My wife never complains about a missing or vagrant sock. Her sock drawer is impeccable, everything neat and tidy, row after row of happily matched socks all rolled up in cute little bundles. Not a misfit among them.

Of course women suffer more than men do from another mysterious effect—peculiar goings-on in closets when the lights are out and the doors are closed. Every time they leave an empty coat hanger in the closet overnight, it is immediately joined by a half-dozen of its relatives. But that's another story.

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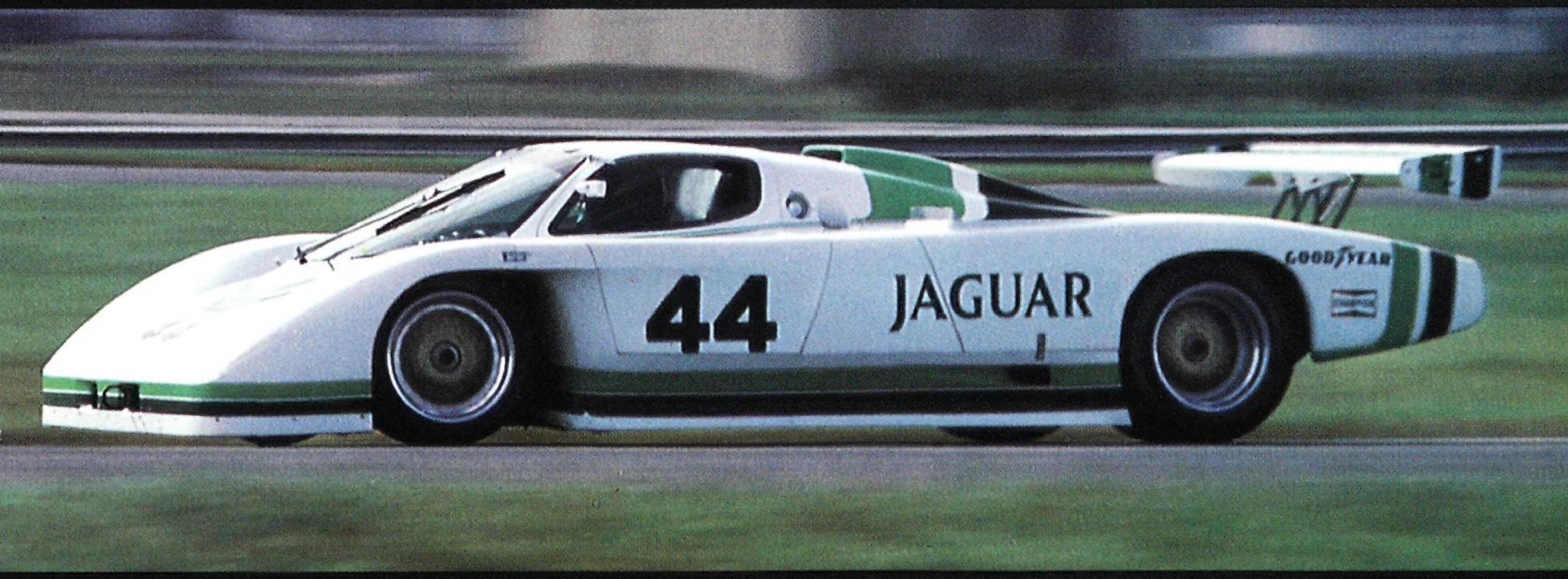


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